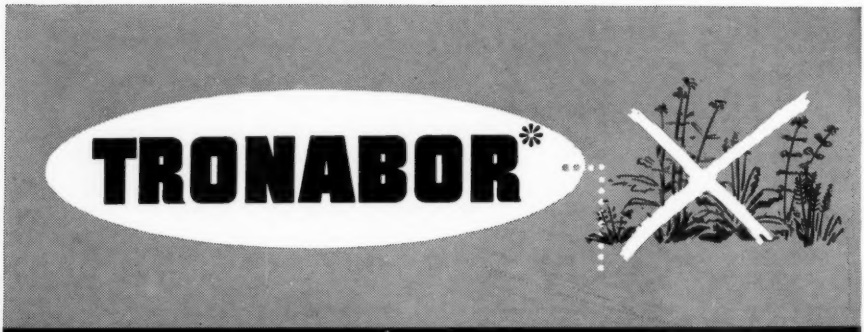
Better Crops WITH PLANT FOOD

February 1954 10 Cents

(Turn to page 31)

The Pocket Book of Agriculture



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• • • • •

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Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth

R. H. STINCHFIELD, *Editor*

Editorial Office: 1102 16th Street, N. W., Washington 6, D. C.

VOLUME XXXVIII NO. 2

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One of the first operations of the season—getting the fertilizer onto the soil.

Better Crops with PLANT FOOD

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VOL. XXXVIII WASHINGTON, D. C., FEBRUARY 1954 No. 2

During a Visit. . .

Back to the Campus

Jeff McDermid

BRIGHT placards saying "Prove You Are 18" challenge me on every wall from the bar stool on which I linger—hunting for those haunting memories of long ago in this ever-pulsating, careless realm of the college student. But at no wide stretch of the most vivid imagination could I ever prove again that I am eighteen. Perchance I would gladly relinquish the thirst-quenching privilege of my years, which are always unquestioned by the deft polisher of the shining glasses, just to find out once more what it feels like to be eighteen—or even that more staid and aged status of twenty-five or six.

In these roistering, traditional college towns one who has passed his middle years, either deeply appreciates the chance to mingle with jubilant juniors or walks slow-footed with downcast eyes, wondering why each husky Joe or bright-eyed Jenny fails to greet you with some current password to the lodge of youth.

Not all of the old landmarks have disappeared from the familiar mile that separates the "gown and town" precincts of our elm-lined quarter. It is thus possible to recreate some of the drama and bring back to ruddy life some of the young characters who once used that scenery for backdrops to a world of study and ambition, pranks and cribbed exams. But so few of them are yet visible in the warmth of their glorious flesh, to bring back again the carefree, hopeful, joyous and ardent camaraderie that stamps this ordinary avenue into a pathway of the demi-gods and vestal virgins entering in turn to claim the prizes of erudition.

If you were a resident instructor or a full professor or dean, smug and secure on his pedestal of power and reputation, this lonesome and nostalgic spirit might not move you almost to the point of useless and unbecoming tears. The secret of that indifference to the pressure of youthful zest lies in their annoyances and irritations coming every day from the humdrum routine of class and supervisory duty. They, unlike yourself, live in a world of reality and know too well that many of the most brilliant looking kids are stumblers and quitters on the rocky road to Parnassus, and drive too many motors for the good of their mentors.

RIGHT here in this matter of motor cars it seems too clear that the old campus is like it used to be in a county seat on circus day. Getting longer and heavier and costlier, these believed-to-be-necessary means of transportation swerve and dive and bedevil you, block all the curbs from downtown to the campus, and represent in their plush possession more than it cost for four years of academic schooling when you were there. Moreover, parking space is just about completely gone, so that the latest proposed novelty directed to the ease and comfort of the generation that has forgotten how to walk is intended to uproot a bygone vista on the lake. The proposal has been debated and it may be halted. The plan in question would fill in a huge chunk of shoreline on the placid lake to give the undergrads and the book salesmen and other transients a nice plaza on which to park their limousines.

Great stretches of gravel, huge posts and signs, row on row of personal pleasure cars shimmering in the sun, honking and grinding of machinery, reeking odors of oil and gas,—over and beyond and between which display of opulence one partly glimpses the rolling blue of the wide waters fringed to the far left by a vista of hills soon to be hidden from all except those who ride in planes!

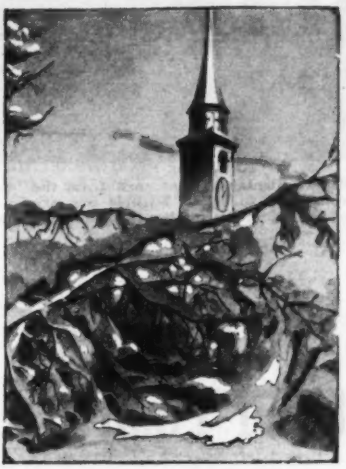
Of course, there is another side to the situation. That campus you and your friends knew so well has extended itself for miles beyond the farthest western rim of the college zone as you vision it of yore. This means some fast traveling between many classes to avoid bad marks. Unless and until all the major classes are broadcast by television, some of the students will have some justification for operating a motor car in their daily rounds. I presume a few of them still work at various college and town jobs to earn their board and keep. They have to hustle also, but most of these less privileged and independent ones surely cannot afford to maintain wheels under themselves.

LET'S quit arguing generalities a minute because here we are opposite a spot that is green with ancient memories. It's the brownstone chapel with a short spire, facing straight down the main thoroughfare connecting the campus with commerce. In that somewhat stuffy place you heard some famous men and women invited to appear before the student body. Here the winning debate team repeated their victorious arguments for the benefit of those who did not accompany them on the trip. Similarly, the winning orator of the Midwest Speech Contest went through his vocal and mental tricks, garnished with graceful gestures. Sometimes, when the lower campus was too wet or snowbound, the triumphant football and basketball teams strutted their stuff and heard the cheers of the welcoming students.

Just a few blocks east stood a house now hidden by a garish store front. Up there on that hill behind those Victorian era blinds and doorways lived a professor who held many parties for the students. It later became the rented house of a "barbarian" self-named fraternity called the Cardinal Cat. Probably no other spot in existence on the old campus carries quite the flair for you as that old gathering place of the

young and the daring. One of those promising lads of long ago is a noted authority on literature, named to make the chief address when the new college library is dedicated next month. He recalls our club vividly and with endearment too, as he told me in a recent letter. The best things are never forgotten by the best of minds. Or if they sometimes are, a quick glimpse of a familiar locale starts the reel of memory clicking strong.

He alone of our crew of robust stu-



dents ever realized a dream of being famous and renowned. Another lad of those days became a state senator and another one held a high position with the government as an administrator. Still another dedicated his life, he used to tell us, to the accumulation of great riches. He said that when he became forty years of age he would be a millionaire. He finally had to be satisfied with far less, yet the last time I saw him he looked prosperous but rather baggy in the face and corpulent in the midriff.

IT takes a fellow with a blithe spirit and practical resignation to view the wrecks that once were handsome homes along some of the side streets abutting the campus. In those now crumbling and decayed houses built in the nineties and at the turn of the century there once were vibrant life and jollity. The houses were large and roomy, and their owners often rented upstairs rooms to the student body—mostly men—who could not find the space or the finances to reside in fraternities or clubs. After the men's dormitories were erected the former homes that bulged with youth soon became empty of the usual paying occupants and their owners faced rising upkeep and excessive fuel bills. Moreover, as the demands for services grew, the college management sought to expand its limits and condemned acres of residential land where many of those Victorian houses once sheltered and sometimes "boarded" the overflow of freshmen and sophomores, whose parents wanted their boys to live in somebody's home and have some kindly housemother to keep tab on their welfare and behavior, too.

Maybe it is just as well, for some of the huge, rambling houses were firetraps and lacked the conveniences of modern times. But as you gaze into some of those vacant and staring windows you recall many an evening of social cheer, with the owners calling each boy by his nickname, and doing his best to be a dad to homesick kids, especially for many a lad who could not afford a trip back home at the holidays.

From thence you slowly pace the campus walks to the portals of the new and impressive "libe." It contrasts sharply with the old one facing it across the lower greensward, Grecian and Roman, with Ionic columns and sculptured pilasters. The modern library looms like a warehouse of brain storages, stark and flat, ponderous and practical. In former times the architectural grandeur and the marble trimming of the interiors made you overlook the actual lack of adequate reading and reference facilities. Erected at the time when new-found wealth and booming ambition prevailed, the Athenic marvel caused no end of pride in your genera-

(*Turn to page* 50)

Fig. 1. County Agent J. W. (Bill) Clark and Francis Blaska display ears of corn from the "with" and "without" treatment. The yield was increased from 32.2 to 102.9 bushels per acre where 1,000 lbs. per acre of 10-10-10 were plowed under and 200 lbs. of ammonium nitrate were applied as a sidedressing.

Wisconsin Tops the Nation's 1953 Average Corn Yield

By C. J. Chapman

Soils Department, University of Wisconsin, Madison, Wisconsin

THE year 1953 will go down in history as a great one for corn in Wisconsin. Corn was king, with yields hitting an all-time average high of 58½ bushels per acre (the highest yield for any state in the United States) and totaling better than 148,000,000 bushels.

There were many factors that contributed to this all-time record: Hybrid seed corn, a stupendous contribution resulting from years and years of research by our plant breeders and geneticists; higher population (more stalks per acre). And farmers have learned that weed control is important.

But one of the most important factors contributing to this record yield was high fertility. Some 900 farmers joined up in the county Pacemaker Corn Clubs, had their soils tested, and applied fertilizer according to a prescription or formula. Thousands of others just proceeded on the general assumption that an abundant supply of plant food and the stepping up of the population would turn the trick—and it did.

Many stories on how to grow 100 bushels per acre appeared last winter and early spring in the leading farm magazines. Interest in fertilizers for corn and how to grow these big crops

ran high. In a series of some 37 radio talks over stations in southern Wisconsin during the months of April, May, and June, we gave farmers blanket suggestions and recommendations. We said, "Step up your stands to 16,000 to 18,000 stalks per acre on the heavy soils (10,000 to 12,000 stalks per acre on sandy soils), and where no manure is available, plow down or disc in 800 to 1,000 lbs. of 10-10-10 or 12-12-12 fertilizer. Drill or hilldrop your corn and drill 250 to 300 lbs. per acre of 4-16-16 or 5-20-20 starter fertilizer and then when your corn is knee-high, apply 200-300 lbs. of ammonium nitrate, anhydrous ammonia at 80 to 100 lbs, or other high nitrogen fertilizer to supply the equivalent of from 60 to 80 lbs. of elemental nitrogen." That treatment paid off with yields ranging from 100 to 165 bushels.

L. J. Merriam, a farmer east of Janesville who has grown corn continuously for 4 years (a one-crop farmer), plowed under about 500 lbs. of 5-20-20 plus 350 lbs. of ammonium nitrate, used starter (5-20-20) at 100 lbs. and, for good measure, sidedressed part of his acreage with anhydrous ammonia at 80 lbs. per acre. Yields on his 150 acres of corn ran close to 135 bushels per acre. Merriam got his corn a little too thick—from 20 to 21 thousand stalks per acre. He drilled at 7-inch spacings, but next time he tells me that he plans to hilldrop "twos" every 17 inches on 42-inch rows. Merriam is convinced that light penetration with direct sunlight hitting a higher percentage of the leaf surface is important in processes of starch and sugar formation, and hilldropping on wider rows will permit more direct sunlight to hit the leaf surfaces.

Certainly our test plot demonstrations carried out over a period of 35 years in Wisconsin, together with the research studies conducted both here in Wisconsin and other Midwestern States, have given us a tremendous backlog of information from which we continue to draw. Our knowledge of "how to grow corn" has been cumulative. I started my first work on corn fertilization back in 1916 as a young agronomist working under the direction of Dr. H. J. Wheeler who was then recognized as one of the outstanding authorities on fertilizers in this country.

Fig. 2. Sidedressing attachments for applying straight nitrogen or mixed fertilizers are available now for all makes of tractors.

Down through the years my work has been inspired and supported by such men as Dr. G. N. Hoffer of the American Potash Institute and Dr. Geo. Scarseth, formerly Chairman of the Department of Agronomy at Purdue (now director of the American Farm Research Association). Over a period of more than 35 years county agents have cooperated in these hundreds of "in the hill," "plow-sole," "plow-under," "sidedressing," and other types of corn plot fertilizer demonstrations. I have written and talked so much about 10-10-10 for both corn and pastures for so many years that I'm now being nicknamed "10-10-10 Chapman."

As more abundant supplies of nitrogen came into the picture following World War II, we all, the whole country, began to see great new and expanded opportunities for its use.

A story which I prepared in 1947, entitled, "Nitrogen Fertilizers Have Extended Crop Production Horizons," and which appeared in one of the National trade magazines, alerted the country to the great opportunity for low-cost crop production through the use of nitrogen. My story entitled, "Wisconsin's Soil Bank Balances Are Running Low on Nitrogen and Potash," which appeared in the January 1953 issue of this publication and which was based on a study of "income and outgo" of N-P-K, revealed the fact that Wisconsin's net losses of plant food for 1952 were 35,450 tons of nitrogen, 54,281 tons of phosphate (P_2O_5), and 170,768 tons of potash (K_2O).

This past year in cooperation with county agents we set up a total of 60 demonstrations where comparisons of heavy rate plow under 10-10-10 treatment with starter only and nitrogen sidedress treatments were made.

The results of a few of these 1953 demonstrations are shown in Table I.

"Will it pay farmers to apply these heavy applications of commercial fertilizer?" Let's take a quick look at costs where heavy rate per-acre applications of fertilizer are applied to low level fertility land.

800 lbs. 10-10-10 fertilizer (plow under)	$28.80
200 lbs 4-16-16 (starter)	6.65
200 lbs. ammonium nitrate (sidedress)	8.40
Total cost of fertilizer	$43.85

(*Turn to page* 45)

Fig. 3. Anhydrous ammonia must be injected into the soil with special applicators as shown here.

Soil Testing Improves Soil Management

By C. L. W. Swanson

Soils Department, Connecticut Agricultural Experiment Station, New Haven, Connecticut

A PERTINENT fact about soils is that no one can look at a soil or feel it and say a great deal about its fertility. Much can be said about its potential productivity, however, from visual observation.

If a soil is well drained, most crops will grow well; but if water stands on the land much of the time, the land is water-soaked and too wet for best crop growth.

If stony, it is difficult to work. If the topsoil is thick, the plant roots have a larger storehouse from which to get their food and moisture.

The soil may be well drained and stone free with thick topsoil, but poor in fertility.

But the chemical or fertility status of a soil is not visible. It is best learned by chemical analysis. Intensive researches on methods for determining quickly the fertility status of a soil have produced the commonly known soil quick tests.

Sampling the Soil

One of the most important factors in obtaining reliable information on the fertility status of a soil is the taking of representative soil samples. Several samples should be taken for, if only one is obtained, it might happen to be from an unusually poor part of the land. Or you might sample a spot where some fertilizer was accidently spilled last year.

The sampling must be properly done if the tests are to have significance. The interpretation of soil tests is based on the assumption that the sample actually tested is truly representative of the soil in the particular field or area sampled. Soils that are different in appearance, crop growth response, or past treatment should be sampled separately.

No simple rule for soil sampling will apply to all cases. Common sense is the best guide, bearing in mind that the final mixed portion actually subjected to test is only a spoonful from an area of land usually consisting of thousands of tons of soil. If the sample is not representative, the tests may lead to erroneous interpretation and unsound recommendations.

If poor soil samples are submitted to the laboratory, poor results may be expected. The best laboratory technique is not a substitute for carefully taken samples.

How to Sample Soil

In cultivated fields and gardens, the soil is sampled by taking vertically cut shovel or trowel slices of uniform thickness to a depth of 5 or 6 inches. For permanent sod, such as pastures and lawns, the depth should be 2 to 3 inches. A soil auger is sometimes used for sampling.

Ten to 20 samples well distributed over the field, garden, or lawn should be taken. The number of places sampled depends on the size of the area and the uniformity of the soil. The samples should be mixed thoroughly in a clean pail or similar container and the larger stones and coarse roots removed. From a half pint to a pint of this mixture is sufficient to save for testing.

If the soil is very wet, it should be

spread out to air dry before mixing. It should not be dried in a heated oven. Usually it is inadvisable to sample when the soil is saturated with water or when extremely dry. Care should be taken that sampling tools and containers are free of lime, fertilizer, or other contaminant.

Fields that vary in kind of soil, previous fertilizer or lime treatment, or cropping history should be sampled separately. Gardens should not be sampled with lawns.

Separate samples from the subsoil may be desirable for the additional information they will provide. This would be helpful in the case of orchards, for example.

Include Information About the Soil

Any information supplied with the sample is helpful to the soil scientist making the test. The soil type name, if known, characterizes the soil, telling something about its physical and chemical properties useful in the interpretation of the tests.

The past cropping history and soil treatment for the past 3 to 5 years provide useful information. Has the soil even been limed, have fertilizer and manure been used? Do you know the kinds and amounts? Do you have manure available now for use on your soil? Also, what crop are you going to grow?

Other factors on which information is useful include drainage, whether the land is hilly, rolling, or level, material underlying the soil such as sand, gravel, or bedrock, and approximate size of the area represented by the sample.

Time of Sampling

The soil is a dynamic body, teeming with millions of microorganisms whose activities vary from day to day and from season to season with changes in temperature, moisture, and food supply. A rapidly growing crop depletes soil of the nutrients required for plant growth. Thus, at the end of the growing season, soils show high tests for nitrates and potassium only when the amounts of these constituents added in the fertilizer, or becoming available in the soil, are in excess of crop demands. Seasonal fluctuations in soil acidity influence the availability of plant nutrients to some extent. Acidity is normally at a minimum in early spring and at a maximum in midsummer.

For general soil diagnosis, tests on samples taken in early spring are most reliable. Tests in the autumn after the crop is harvested best indicate whether or not the fertilizer has been in excess of crop needs. Fall testing has the added advantage of allowing ample time in which to obtain materials and lay plans for spring work. The choice of time when the sample is to be taken depends, therefore, upon the purpose for which the test is made.

Interpreting Soil Tests Important

Simple chemical soil tests can often provide us in a few minutes with more useful information about the fertility of a soil than can be learned by several days of detailed laboratory analysis. The results of the tests can be used to good advantage by a person competent to give sound soil-management recommendations. They are often misleading to those who have little understanding of the relationships between soil chemistry and plant nutrition.

Soil testing is only another tool used by soil scientists in diagnosing soil ills. It is not infallible. In the hands of a novice, great harm may be done soils from an incorrect interpretation of the tests. For example, a novice might recommend liming when actually sufficient calcium was available in the soil. Overliming may produce minor element deficiencies.

Practical interpretation of soil tests should be considered with reference to known limiting factors on crop growth for the soil being tested. These limiting factors include poor soil aeration, poor soil structure, deficient drainage, low organic matter content, unfavorable seasonal conditions, plant pests, and plant diseases.

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Lime and Fertilizer Pay Off*

By W. L. Nelson

Agronomy Department, North Carolina State College, Raleigh, North Carolina

WE'VE all heard that farmers, like everyone else, must spend money in order to make money. This certainly applies to the use of lime and fertilizer in crop production in North Carolina. Our soils, naturally low in productivity in the virgin condition, are among the most responsive in the nation to good management and cultural methods.

Farmers in North Carolina have recognized the importance of fertilizer in securing high yields, as indicated by the fact that in the last 15 years fertilizer tonnage has about doubled. North Carolina uses more fertilizer than any other state—a total of 1,850,000 tons for fiscal 1952-53. The actual usage in tons of N, P_2O_5, and K_2O and lime is shown in Figure 1 along with the estimated potential usage.

Although many acres in North Carolina are well limed and fertilized, these estimates indicate that much of the cropland needs more nitrogen, phosphate, potash, and lime than is being applied. One is often impressed with the sharp contrast between the improved farm and the rundown farm. Often the two situations are divided by only a road, property line, or just a fence row. If one doesn't know the real situation, he can scarcely believe that most of the fields could be as good as the better fields just by following good management practices. Naturally, lime and fertilizer are only two of the many factors in management necessary for high production. Full attention must be given to the seedbed, variety, date and rate of seeding, stands, fertilizer placement, cultivation, insect control, disease control, harvesting practices, as well as other factors.

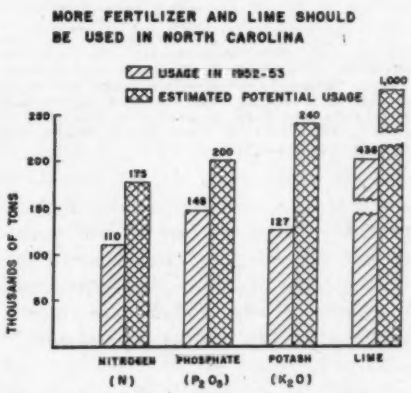

Fig. 1. Nitrogen usage potential calculated on basis of current recommended rates; the phosphate, potash, and lime usage potential calculated on basis of current recommended rates and summary of soil tests showing phosphate, potash, and lime levels in North Carolina soils.

It is interesting to note that the price of fertilizer has increased much less than other items the farmer must buy. Also, it has risen much less than prices received for produce (Figure 2). The price index on fertilizer in 1952 was 143 (based on 1910-14 prices = 100). In the same year, the price index for all the commodities the farmer bought was 273, while the price index for products the farmer sold was 288.

Adequate Lime and Fertilizer Pay

It costs just as much to prepare the land, plant and cultivate a low-yielding field as it does a high-producing field. Once it is decided to produce a certain crop, it will pay to add plant nutrients

* Based on North Carolina Agricultural Experiment Station Bulletin No. 385, December 1953. "Lime and fertilizer pay off."

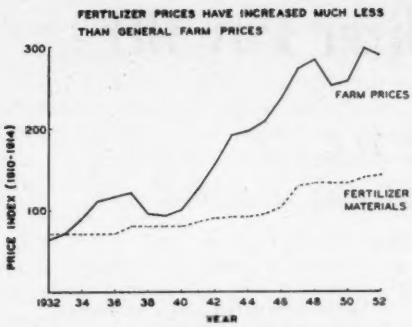

Fig. 2. "Prices farmers receive" are U. S. Department of Agriculture figures, revised January 1950. "Prices of fertilizer materials" are based on figures from the Department of Agricultural Economics and Farm Management, Cornell University, Ithaca, N. Y. See Better Crops with Plant Food, Jan. 1953.

close to that amount where the expected value of the larger yield equals or just exceeds the extra cost of fertilizer, plus additional harvesting and marketing costs. Here are figures based on 54 corn fertility experiments.**

	Low nitrogen	120 lbs. N
Yield.....	26 bu.	85 bu.
Cost per bu.....	$1.71	83 cents
Net returns.....	$1.12 loss	$71.75 profit

Adequate phosphate and potash were applied.

For any management practice, a farmer wants to know, "Will it pay?" So naturally he is interested in the net return from dollars spent on lime and fertilizer. Sometimes the farmer may have a problem in obtaining credit to buy the plant nutrients he needs. Credit agencies and fertilizer dealers are very much interested in the returns per dollar spent for fertilizer. If it is plain that $4 or $5 or even more will be returned for each dollar spent for lime and fertilizer, there should be little difficulty in obtaining the necessary credit.

** "Fertilize corn for higher yields" by B. A. Krantz and W. V. Chandler, N. C. Agr. Exp. Sta. Bul. No. 366 (revised, in press).

Apply Plant Nutrients Needed

To get the most efficient use of the plant nutrients applied and the greatest returns from the fertilizer dollars, consideration must be given to other factors besides just applying more lime and fertilizer. On some soils the greatest returns may result from lime, on other soils the greatest return may be from nitrogen, phosphate, potash or a combination of one or more of these nutrients.

The effect of soil fertility on response from plant nutrients is illustrated in Figures 3 and 4. The values per acre of the increased yields from lime or fertilizer (above the cost of lime or fertilizer) are given. Farmers will be most interested in the figures above the bars as these figures represent the return per acre above the cost of the fertilizer. Fertilizer dealers and credit agencies will be most interested in figures below the bars. These figures show the returns per dollar spent on fertilizer or lime. It is well to keep in mind that the value per acre of the increased yield is the most important figure, since this is directly related to the profit per acre. It is important not to be misled by the decreasing returns per dollar spent on

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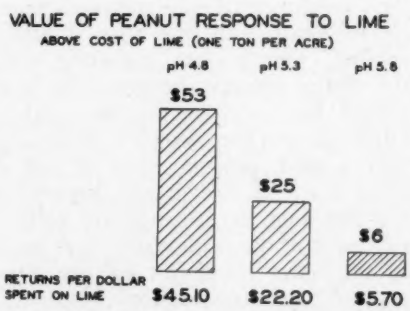

Fig. 3. Peanuts require a properly limed soil; response depends on acidity. The returns, $45 per dollar spent on lime on the low pH soils, show clearly the profits you can earn from liming. Seventy-four per cent of the peanut soils are pH 6.0 or below. Adequate plant population and insect and disease control are important in realizing full returns from plant nutrients. Norfolk series in Coastal Plain.

Feed in the Northeast Buy It or Grow It?*

By Richard Bradfield

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DAIRY and poultry contribute about 75 per cent of the gross farm income of farmers in the Northeastern States. Both are dependent largely upon concentrates imported from the Corn Belt. New York farmers alone spent $169,000,000 for imported feeds in 1949. This was by far their largest cash expenditure. It was almost twice as big as their expenditure for farm labor, six times their expenditure for lime and fertilizer, and seven times the amount that they spent on their farm taxes. They are feeding, each year, about three million tons of concentrates, of which about one third or one million tons, is home grown, and the other two million tons imported from the west. Since 1920 about thirteen million acres of land in the northeast have been abandoned. The total cropland in the area has decreased over six million acres.

The ratio of prices received by farmers of the Northeast for their products to the prices paid for goods and services is more unfavorable now than it has been for a long time. If the Northeast farmer is to operate profitably during the price-cost squeeze which now exists and which will probably continue, he will have to reduce his production costs. Because his biggest cash outlay is for purchased concentrates, this item offers greater opportunity for reduction than any other single item.

The purpose of this paper is to consider some of the possibilities open to Northeast farmers for increasing their net income in the years ahead by reducing their expenditures for imported feed. I shall confine my remarks largely to the situation of the dairy farmer, and shall draw most of my illustrations from New York State.

Grass has long been, and will probably continue to be, the most important crop in the Northeast. The climate and soils are, in general, well adapted to grass. One of the disadvantages is a relatively long winter feed period.

It is commonly accepted that the cheapest source of digestible nutrients for cattle is grass, and that the dairy farmer in the Northeast should aim to supply as high a proportion of the feed needed by his herd in the summer in the form of pasture as possible, and as high as possible a proportion of his winter feed in the form of hay or grass silage. It has generally been considered that the necessary concentrates could be purchased more advantageously from the surplus-producing areas in the west than they could be grown in the Northeast. It seems to me it is now time to examine this view critically in the light of developments of the last quarter of a century, and of probable developments in the next.

There is no question but that grass should continue to receive major emphasis in the agriculture of the Northeast. The research and experiences of our better farmers during the past 25 years furnish convincing evidence of

* Presented at Boston meeting, American Association for the Advancement of Science, December 29, 1953.

the potentialities for very great improvements along these lines. During this period we have had the establishment of the Northeast Pasture Research Laboratory in Pennsylvania; pasture and forage crop specialists have been added to the Research and Extension staffs of most of our land grant colleges. Two important new legumes have been introduced—ladino clover and birdsfoot trefoil, both of which have great promise in connection with the improved grassland program. As a result of the work that has been done in the last 25 years, we now know much more about how to grow better grass in the Northeast, and we have a better picture of what it can contribute to the agriculture of the area.

We know it is possible to produce pastures in the Northeast which will carry one dairy cow per acre, and to have meadows which will produce from two to three tons of high-quality hay for winter feeding. Dairy farmers have also learned to appreciate the value of high-quality roughage, roughage which contains a high proportion of legumes and which is harvested at the right stage of maturity. It has been clearly demonstrated that if roughage is of high quality, the dairy cow will consume more of it. At least 25 per cent more of the total digestible nutrients needed in milk production can be supplied in the form of grass if it is of high quality. In spite of the fact that this is known to be true, the quality of the grass being produced on the majority of the dairy farms of the Northeast is still far from easily attainable goals.

Points of Information

We have fairly accurate information on what must be done to secure these better grassland crops:

1. The most common cause of failure in most of the area is still the use of inadequate amounts of lime. Most of the soils of the Northeast are still too acid to produce the best pastures and meadows.

2. Most of the grassland of the Northeast is still inadequately fertilized. Practically all of these soils need to be fertilized with phosphorus. A high percentage of them need potash in addition to phosphorus. On farms where a high proportion of legumes cannot be maintained in the stand, nitrogen also will have to be supplied from some commercial source. The experience of our better farmers is that both more adequate liming and heavier fertilization can be made very profitable at present price relationships.

3. Many of the soils of the Northeast must be better drained if they are to give maximum returns from grassland crops. Many of our better forage legumes will not thrive in poorly drained soils. This drainage problem is not as serious, or as costly to correct, as in many areas of flat land in other sections of the country. Most of the Northeast is rolling, and consequently surface drainage is good over a high percentage of the area. There are, however, on practically every farm, wet spots which hamper the farmer's operations and increase his expenses. These areas must be drained if the land is to be farmed efficiently.

4. Most tillable grassland should be plowed up occasionally and reseeded to improve seeding mixtures. The evidence is rather conclusive that under most conditions in the Northeast, stands of grass used for either pasture or meadow tend to deteriorate with age and are greatly improved by plowing up, planting to an intertilled crop for a year, and then seeding back to grass, usually in a small grain crop. In spite of this evidence, the fact remains that most of our meadows are left down too long, and as a result, both yield and quality of hay suffer.

5. To secure the maximum efficiency from the use of forage crops, they must be harvested at the proper stage of maturity. In the Northeast, the proper stage is often two to four weeks earlier than is customary. If all the crop is to be harvested at the proper stage,

this greatly shortens the period of time over which a high-quality crop can be harvested. In other words, it makes it necessary on most farms to compress the harvesting season to a period of from two to three weeks, instead of spreading it over two or more months, as is still the practice in many sections. This fact makes greater diversification both advisable and possible.

Harvesting Techniques

In the last 25 years, we have developed machinery and techniques for harvesting and storing grass which greatly reduce the labor of handling and the losses on storing. These costs are, however, still high. Losses in feeding value between meadow and manger are also still high and generally amount to from 20 to 30 per cent. Good grassland farming will increase yields per acre from 50 to 60 per cent. One of the consequences of improved grassland farming on many farms is a reduction of the acreage of grass needed to support our present cow population. In time this reduction might well amount to 25 per cent of our present hay acreage of almost four million acres, or almost a million acres of plowable land that is now being farmed.

We have in New York State about 1,250,000 milking cows and about 500,000 heifers, or a total of 1,500,000 cow units. The number of cows in the State has shown but little change in the last 25 years. It will probably not change much in the next 25 years. The increased production needed will probably come from increased production per cow. If the pasture supply for these animals is of the quality necessary for efficient milk production, from 1.5 to 2 acres should provide adequate pasture for one cow. This would require a total of about three million acres if we use the more liberal of these figures.

The 1950 census lists over 6,000,000 acres of land being used for pasture in New York State. The amounts of the various types of grassland in New York as reported in the 1950 census are given in the first column of Table I.

Woodland pasture, in most cases, contributes very little feed. It usually should be either cleared and converted into improved pasture or reforested. If two thirds of the poorer part of this total area were reforested, it would leave one third, over 450,000 acres for pasture. When added to the "permanent pasture," this would make a total

TABLE I.—SHIFTS IN LAND USE POSSIBLE IF GOOD GRASSLAND FARMING PRACTICES ARE USED AND COW NUMBERS KEPT CONSTANT

(Estimates for New York State)

	1950 (Acres)	Proposed for grassland (Acres)	Freed for production of other feed crops (Acres)
Hay land (Average of 1945 & 1950 census)	3,585,000	2,585,000	1,000,000
Yields in tons/acre assumed	1.4	2.0	
Tons of hay produced	5,018,000	5,170,000	
Pasture			
Woodland pasture	1,361,000	450,000	911,000 (for reforestation)
Permanent pasture	3,125,000	3,125,000	
Cropland used only for pasture	1,579,000	789,000	789,000
Total pasture	6,065,000	4,364,000	
Total grassland	9,660,000	6,949,000	
Total area released for feed crop production			1,789,000

of 3,575,000 acres for long ley or permanent pasture. By long ley pasture, I mean pasture which is on land which can be limed and fertilized and which can be plowed up or renovated perhaps once every 10 or 12 years, but which is left in grass for at least 90 per cent of the time. I seriously doubt the advisability of keeping land in pasture for dairy cows in the Northeast which cannot be limed, fertilized, and occasionally renovated. Otherwise, the quality of pasture in most cases will be too poor to justify its use by high-producing herds.

We have left, now, according to the Table, 1,579,000 acres of so-called plowable pasture. This land should be used for relatively short feed-producing rotations, with the land in grass about half of the time. The shifts which I propose are shown in the last two columns of figures in the Table. The assumptions made in assembling this Table are that with good grassland practices, the yields of hay can be raised from an average of 1.4 to 2.0 tons per acre. This would give, with the acreages shown in the Table, the number of tons of hay shown in the second line in the Table, and provide for essentially the same tonnage of hay as is used at present. The area of cropland used only for pasture is reduced by half, and the half thus freed would be used for the production of corn and small grains.

Shifts To Be Made

Quite often, in the experience of New York farmers, the intensively managed grass grown in the shorter rotation just described can be cut for grass silage or hay in early June, when the farmer usually has a surplus of grass in his permanent pasture, and can be pastured in mid-summer when his permanent pasture is short. This proposed reallocation of grassland would leave almost seven million acres of land in grass, or almost five acres per cow unit. It would return almost a million acres to forest and would free 1,750,000 acres for the production of other feed crops. All of the shifts considered so far involve only land that is now being farmed. We realize, of course, that the situation on individual farms varies quite widely and that many farms are already in proper adjustment, but in view of the average figures shown in this Table such farms are probably a small percentage of the total.

Summarizing the picture with respect to grasslands, it seems to me that we can safely say that grassland is, and will remain, the chief support of the dairy industry of the Northeast, but that if the potentialities of grass as a dairy feed are to be realized, the quality of the pastures and meadows will have to be improved. If the quality is improved, the yield per acre will, in general, be raised, and as a result of better grassland-management practices, the total amount of land required to produce all of the grass that the present and prospective cow population can consume can be reduced in New York State by about 1,500,000 acres, which can then be devoted to other purposes.

Two Possible Uses

There would seem to be only two possible uses for most of the land thus freed: 1, to abandon it; 2, to use it for producing feed crops, thus reducing cash expenditures for feed imported from other regions. If we follow the pattern which has been followed over the last half century, this land would simply be abandoned and allowed to grow up to trees. Some of it should probably be abandoned. I seriously question, however, the advisability of abandoning a very high proportion of it.

When land was being abandoned in the Northeast on an extensive scale 50 to 75 years ago, rich virgin soil was available in the Corn Belt at very low prices. This situation has changed. Land in the Corn Belt is no longer cheap. Good farm land in Illinois is selling for from $300 - $600 per acre. In other words, land is worth from five or six times as much as in many good

farming sections of the Northeast. The store of fertility of most of the soils of the Corn Belt is not as high as it was a half century ago. Farmers in that area are using more lime and fertilizer every year. As a matter of fact, fertilizer consumption is increasing more rapidly in Iowa, on a percentage basis, than in most of the other states in the country. Yields of corn, oats, and wheat on the better managed farms in much of the Northeast will compare very favorably with average yields obtained in the surplus grain-producing areas of the west. One of the biggest advantages of the farmer in the Northeast is that he has, in most cases, a market for all of the feed he is likely to be able to produce on his own farm or on that of a nearby neighbor. To reach this same market, $30-$32 a ton must be added to the cost of the corn on the farm in Illinois before it can be delivered to a dairy farm in New York. Freight rates and other handling charges continue to increase. There is little probability of there being any reversal of this trend in the foreseeable future. This cost of getting a ton of grain from the surplus-producing areas of the west to the feed-deficient areas in the Northeast is equivalent to about 80 cents a bushel in the case of corn, and is approximately the same as the cost of production of a bushel of corn on some of the better farms in the Northeast. There is a high degree of probability that the prices of feed grain will continue to be supported at a fairly high level by the Federal Government. If grain is supported at or near present levels, and the transportation costs are added to this price, it makes grain production very attractive for the farmer in the Northeast who has, or can get, the necessary land.

Higher Labor Returns

Records from cost account farms in New York show that in recent years corn for grain and wheat have given higher labor returns than hay or even the care of dairy cows. This would seem to indicate that any labor diverted from these other activities could be very profitably used for grain production. Many of our New York dairymen are changing their barns so that they can use the new pen-stabling method of handling their herds. This method has been shown to have many advantages over the old stanchion system. It has, however, one serious disadvantage. It requires more bedding. Bedding is often expensive in the Northeast. Many years, bedding is almost as expensive as hay. The farmer who produces grain in the form of wheat, oats, or corn will normally have no bedding problem. As a matter of fact, some of them may have surplus bedding to sell to their neighbors.

Re-examining Land

In our discussions this far, we have considered the possibility of feed production on the land which is now being farmed by improving the quality of our pastures and meadows, thus freeing a part of our grassland for the production of other feed crops. There is another important angle to this problem which may be of even more significance to the agriculture of the Northeast in the more distant future. According to the census, there are over six million acres less land in crops in the New England and North Atlantic States than there were in 1920. Much of this land is located on the thirteen million acres of abandoned farm land. We have been interested for the past 10 years in re-examining the feed production potentialities of some of this abandoned land. We have been operating a hill farm of 1,000 acres which is fairly typical of the hill land of southern New York and northern Pennsylvania. Time will not permit a detailed description of this interesting project. I can only say that we have been greatly surprised at the yield of crops which we have been able to obtain consistently on this farm. Yields of corn silage of from 10-14 tons per acre, corn for grain 60-90 bushels, wheat 30-50 bushels, oats 50-85 bushels,

are being obtained on a practical field scale. We are convinced, from the 13 years of experience we have had on this farm, that yields of this order can be consistently obtained with treatments which are economically feasible under present price relationships. If it can be done on this farm, it can be done on a high proportion of the other abandoned farm land in the area.

Bringing Land Back

Why, you ask, was land with yield potentials of this order abandoned in the first place? The soil on these hills is acid. From three to four tons of limestone must be applied before yields like those cited above can be grown. It was exceedingly difficult to haul and spread the amount of lime called for, in the horse-and-buggy days. Nowadays, with spreader service the job is very easy. The farms were formerly small and would not justify the use of modern farm machinery. The fields were too small. But it is an easy matter to tear out old fencerows and make fields of a convenient size with the modern bulldozer. We are using the same type and size of farm machinery on this farm that are being used on the more level farms of the State. Although the land as a whole is rolling, there are many wet spots which must be drained out if the fields are to be farmed efficiently. This may call for an investment of from $20-$30 an acre on some farms. It is not going to be cheap to put much of this land back into agriculture. But it can be done, and I think there is every reason for thinking that in the days ahead it will be done. It has been estimated that by 1975 the population of this country will reach 200 million. Is it likely that we shall be able at that time to have these large areas idle in the most densely populated area of the country and within easy reach of its best markets? This land is well supplied with water and has as dependable a climate as any section of the country.

We might find it profitable to turn for a moment to the experience of England, with this abandoned farm land problem. With the development of her industries, the English felt that their people could be better employed in industry and that the extra food and feed needed could best be obtained by importing it from the newer areas in her colonies. In a recent study of this problem, Ellison states: "The fact remains, therefore, that if Britain needs to increase or even be more certain to maintain her present level of food supplies, she must look to the greater use of her own land for at least a number of years in the immediate future. No one can prophesy far ahead, but it is unfortunate that more was not done to encourage greater efforts of land improvement and reclamation immediately after the second World War, so that the increased production at home could have been available to help Britain in weathering the various economic storms that have blown up since then. Even now no one can guarantee a smooth passage in the foreseeable future. In fact, the state of general shortage persists while the supplies and shortages of individual products shift and vary like the vagaries of a weathercock. At one time it is wheat, at another meat; the position of animal feeding-stuffs has been persistently characterized by shortages and uncertainty. Wool has now joined the list of relatively scarce commodities and in farming these shifts and changes cannot be overcome in the way visualized by the industrialist-turned-farmer, who, anxious to take advantage of the rise in the price of wool and knowing the sheep were lambing, sent his farm bailiff a telegram which stated, 'stop lambing at once and start shearing.' The real position may well be this: that we and other countries with marginal land areas cannot afford to ignore them in view of the world's increasing population and the widespread tendency for the levels of food consumption to rise, especially in those countries which pre-

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Irrigating Flue-cured Tobacco

By C. H. M. van Bavel

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THE grower of flue-cured tobacco is confronted with a problem that does not exist in the production of many other field crops. Not only must he produce the greatest number of pounds per acre possible, but he must manage to obtain a product of acceptable quality. Part of the solution is in skillful "curing" or drying of the leaves after they have been harvested. Also important is the manner and time of harvesting itself. But major factors are the amount of available nitrogen and soil moisture conditions. A certain minimum amount of nitrogen is indispensable for obtaining a satisfactory yield. On the other hand, too high levels of nitrogen while giving still higher yields greatly impair quality, meaning a financial loss and a black mark for the reputation of the producer.

Undependable Weather

Unfortunately, the effect of a certain level of soil nitrogen or of a certain amount of added fertilizer nitrogen depends greatly on prevailing soil moisture conditions. This means that the season's weather is a very important factor in the outcome of a year's work.

At this point the principal point emerges: In the flu-cured tobacco area the rainfall during the summer is extremely variable. Experience and recent investigations all show that droughts are experienced commonly in the Carolina's, Georgia, and northern Florida during the summertime.

It becomes pretty difficult, then for the agricultural research organizations and the extension workers to propose a really sound fertilizer recommendation. In trying to stay in the middle of the road, they usually come up with a formula that fits average conditions. But, as everyone knows, such is a fictitious situation and, therefore, in dry seasons tobacco of poor quality results whereas in wet seasons yields are lower than they might have been.

The farmer is also on the spot because he has no way of knowing what the coming season will bring him by the way of weather. Sometimes, during very wet conditions in early summer, he can do a little sidedressing to partially save the situation, but it is not the real answer.

Tobacco is a high value cash crop with gross values between $600 and $1,100 per acre in recent years. But this is not all profit. Labor, fertilizer, raising of the plants in plant beds represent an impressive per-acre investment. Comparing this fact with the knowledge that the difference between good and poor quality tobacco can easily add up to $500 per acre, it becomes clear how important it is to protect such a high capital investment against the frills of the weather.

Uniform Soil Moisture Conditions Needed

Complete control can, of course, be obtained with supplemental irrigation. The cost is considerable and difficulties are often experienced in locating a suitable source of water. Also, additional skill and care are required from the farmer. But the fruits of all this are likely to be bountiful; in fact, as we will show, it looks as if one can't go wrong in making irrigation of flue-

Fig. 1. Better growth of plants under irrigation results in lower nitrogen and nicotine levels in the leaves and gives a higher priced crop.

cured tobacco a paying proposition.

With the uncertainty in the soil moisture factor removed, tobacco fertilization loses much of the risky aspects that it has at this time. An example of the importance of weather conditions was given very clearly during the 1953 season in North Carolina. The crop in the southeastern part of the State, being planted early, had fairly evenly distributed rain and a good quality leaf that found ready buyers was produced. In contrast, the crop produced in the area around the Virginia-North Carolina border experienced severe drought, and quality as well as quantity was way down. Results were low prices and a slow market. Yet, in this area growers usually aim to the minimum side of fertilizer recommendations because of greater native fertility of soils.

Experimental Results

What will irrigation do in influencing quality and quantity of flue-cured tobacco? In cooperation between the Departments of Agricultural Engineering and of Agronomy, as well as the USDA, extensive studies have been made at Oxford, North Carolina. In all these studies, irrigation has been applied such that optimum soil moisture conditions were maintained throughout the growing season. The minimum soil moisture content was well above the so-called wilting percentage. The amount of irrigation was based on a measurement of the maximum amount of water that the soil of the root zone could contain and the water was put on with a portable sprinkler system.

The time of irrigation was determined by estimating evaporation losses from temperature data, so that no actual measurements of soil moisture content were made. For further discussion of this method, the reader is referred to another source (1).

In all three years a comparison between irrigation and no irrigation was made but, in addition, other factors were studied. These were:

Fig. 2. This tobacco (Dixie Bright 101) was not irrigated. Compare it with that shown in Fig. 1, both grown at Oxford, N. C., in 1952.

In 1951			
liming	vs.	no liming	
900# 4–8–10	vs.	1200# 4–8–10	per A.
In 1952			
liming	vs.	no liming	
900# 4–8–10	vs.	1200# 4–8–10	per A.
In 1953			
36# N	vs.	72# N	per A.

We should explain that the comparison of liming vs. no liming really meant a comparison of high native fertility vs. low native fertility, in view of the resultant growth of legumes in the rotation that was followed in previous years.

Yield Increases

In all three years very significant yield increases were obtained by irrigating tobacco. Averaged over all "recommended" treatments the yields are shown in Table I. In the third column a "least significant difference" is given for easy evaluation of the results. Also, in the fourth column, there is the probability of recurrence of the year's season. This, we should stress, is the heart of the matter. It shows, roughly, how often such a yield increase can be expected to happen. These figures are based on a thorough analysis of prevailing soil moisture conditions and rainfall records at the Oxford location, according to methods described by the author (2).

TABLE I.—YIELD INCREASES WITH FLUE-CURED TOBACCO SECURED BY IRRIGATION AT OXFORD, N. C., IN POUNDS PER ACRE.

Year	No irrigation	Irrigation	L.S.D.	Recurrence
1951	1300	1580	70	2 out of 10 yrs.
1952	1410	1500	60	7 out of 10 yrs.
1953	1320	1790	150	2 out of 10 yrs.

Quality Improved

As significant, or even more so, is the marked improvement in quality that is experienced when one maintains

TABLE II.—VALUE PER HUNDRED POUNDS IN DOLLARS, NICOTINE AND SUGAR CONTENT OF IRRIGATED VS. NOT IRRIGATED TOBACCO AT OXFORD, N. C.

Year	Quality in $ per 100 lbs.		Nicotine in per cent		Sugar in per cent	
	No irrig.	Irrig.	No irrig.	Irrig.	No irrig.	Irrig.
1951..	46.0	58.9	4.02	1.93	14.8	21.9
1952..	52.5	55.8	2.31	1.79	22.0	24.8
1953..	45.1	50.3	.....	.....	.....	.....

suitable moisture conditions. This is, of course, brought about by chemical changes in the leaves. Although to the farmer the price received is the only item of significance, we give here also two of the principal chemical constituents that are involved, namely nicotine and sugar content. As in Table I, the data in Table II are averaged over the treatments representing the usual or recommended practice.

The next item of interest is the effect of different fertility levels combined with irrigation. In order to portray this, we are citing only the data on the value per hundred pounds. Additional extensive data on chemical composition and other effects may be found elsewhere (3).

The evidence presented in Table III is a little less straightforward than what was given before. But it is clear that without irrigation, in general, the depressing effect of increased amounts of nitrogen in the soil is more serious than when soil moisture content is held high at all times. In other words, the deleterious effects on tobacco quality of high levels of soil or added nitrogen can be largely overcome by practicing supplemental irrigation. The data prove, therefore, the point that we raised earlier in this article.

TABLE III. — VALUE PER HUNDRED POUNDS IN DOLLARS OF IRRIGATED VS. NOT IRRIGATED TOBACCO, AT DIFFERENT LEVELS OF AVAILABLE NITROGEN AT OXFORD, N. C.

Year	No Irrigation		Irrigation	
1951	No Lime 53.0	Lime 38.8	No Lime 60.8	Lime 56.6
	36# N 46.0	48# N 45.5	36# N 58.9	48# N 56.2
1952	No Lime 53.8	Lime 51.1	No Lime 56.5	Lime 55.0
	36# N 53.0	48# N 51.8	36# N 55.4	48# N 56.1
1953	36# N 45.1	72# N 40.9	36# N 50.3	72# N 50.5

Economic Analysis

A final verdict on the significance of irrigation for flue-cured tobacco production cannot be given without an analysis of the costs involved. Obviously, this has to be done with some degree of approximation because costs will vary considerably on a local basis.

In Table IV figures are given on the total gross return per acre and the increase owing to the irrigation treatment. In the next column is given the net profit, that is after subtraction of the cost of irrigation per acre. This cost includes amortization and interest on equipment as well as its operation—not the cost of the water supply. It also includes the handling

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TABLE IV.—ECONOMIC ANALYSIS OF EXPERIMENTAL RESULTS WITH IRRIGATION OF FLUE-CURED TOBACCO AT OXFORD, N. C.

Year	Value in $ per acre		Gross increase	Net increase	Recurrence—years
	No irrig.	Irrig.			
1951	598	931	333	295	2 out of 10
1952	740	837	97	69	7 out of 10
1953	595	900	305	265	2 out of 10

Soil and Plant Analyses Increase Fertilizer Efficiency

By Jackson B. Hester

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ON occasion, conclusions have been drawn that climatological factors and soil conditions influence the mineral and organic composition of plant material far more than any readily supplemental application of fertilizer materials or other soil amendments (1, 5, 6, 15). There are several reasons that may influence the drawing of incomplete or inaccurate conclusions from the data at hand.

A number of factors influence the growth of plants, namely: excessive or poor drainage, unfavorable climatic conditions, soil acidity, soil diseases, nematodes, and other conditions (3, 4, 11). Where these conditions exist it is not likely that a moderate application of a particular nutrient will influence the composition of the plant. Furthermore, methods of application of supplements can be a distinct factor. It has been observed that as little as 250 pounds of 5-10-10 fertilizer mixture placed directly in the row where tomatoes were being set so retarded the plants that any supplemental application had little influence on the ultimate yield or composition of the end product. Like the other factors, the method of application of a concentrated salt mixture can alter the composition of the plant one way or the other.

The above-mentioned factors and others lead to the premise that soil and plant analyses and leaching studies are predominant in the use of commercial fertilizers. There can be no question about the fact that if the right amount of plant nutrients are used under the proper conditions, optimum yields may be obtained for the existing conditions. The present discussion is an approach to the use of technology to enhance yields and quality and effectively utilize more fertilizer. Technological information has been accumulated on plant requirements, soil analyses, source of and methods of supplying nutrients, and leaching.

Plant Requirements

Some 15 elements have been proved necessary for crop production. These elements are found in both the soil and air. Carbon, hydrogen, and oxygen are supplied by the air and soil medium, the carbon dioxide being a source of carbon and oxygen, and water a source of hydrogen and oxygen. The plant takes in part of the water and carbon dioxide through the roots and an

Fig. 1. Leaching frames.

additional portion through the stomata of the leaves. It is true that the mineral and nitrogen content of the plant only occupy a comparatively small amount of the total dry weight, 5 to 10 per cent. However, this is a vital part of the plant.

Plants differ greatly in the amount of the various nutrients required for efficient crop production. Soils differ in the amount of elements contained in an available form. Plants are dependent upon the elements in the soil and develop optimum conditions for growth only when these elements are commensurate to the plants' needs.

The mere analyses and the presence of certain elements in a plant does not necessarily mean that these elements are essential to the plant(1). Evidence does not exist to show that cobalt, iodine, and chlorine are necessary for plant growth although these elements are present in many plants (2, 9, 12, 13, 14, 16). These elements are necessary for animals living on these plants; therefore, it is desirable that plants be a source of these elements. Cases of cobalt and iodine deficiency in animals deriving their food from plants grown on soils lacking these elements are known. Evidence exists to show that sodium stimulates growth, particularly in crops like asparagus, beets, cotton, and others (10, 17). Again, certain plants have been known to contain elements, such as selenium and molybdenum and even nitrate nitrogen, in sufficient amounts to cause toxicity in animals feeding upon them (7, 8). The efficiency of the nutrients in the plants in the formation of carbohydrates and proteins is influenced by the amount and intensity of sunshine and other climatic conditions (18). It is noteworthy that the presence of plant nutrients and elements in the plant in optimum amounts necessary for animal life is very desirable.

Vegetables that have a high nitrogen requirement are the leafy type such as cabbage, spinach, kale, collards, and broccoli. Sweet corn and members of the grass family also come in this group. The requirement ranges from 50 to 160 pounds per acre (5).

Fig. 2. Supplemental application of fertilizer on the basis of analyses when plants showed the need. Left—1,500 lbs. 5-10-10 broadcast in one application; right—500 lbs. 5-10-10 in row and 1,000 lbs. in two sidedressings.

Fig. 3. Influence of potash on the growth of collards, nitrogen and phosphorus being optimum. From left to right—0—50—100—200—400—800—1600 lbs. of potash.

The leguminous plants, by and large, have a high phosphate requirement. The nitrogen content of these plants is high, but the fact that these plants are able to fix nitrogen from the air does not place them in the high nitrogen requirement group from the standpoint of fertilization. These plants are likewise divided into two groups—tolerant to soil reaction and those growing under optimum conditions, pH 6.2 to 6.8.

The second group of plants have a high phosphate requirement. Among this group are the high proteinaceous crops which utilize phosphorus in the protein molecule. However, since every living cell requires phosphorus, those plants that make very large vegetative growth require large amounts of phosphorus. Such crops as sugar cane, corn, and sod crops utilize large amounts of phosphorus.

The third group of vegetable crops are those that have a high potash requirement. These are likewise divided into the groups tolerant to soil acidity and those less tolerant. The root and tuber crops, for the most part, have a high potash requirement, utilizing from 100 to 300 pounds per acre. Since these nutrients come from the soil, the most essential factor is a knowledge of the available nutrients in the soil.

Soil Analyses

Soil analyses can be very extensive, such as mechanical, chemical, biological, and other analyses. However, once a satisfactory soil has been selected for the crop concerned, the primary interest is the available nutrients present or likely to become available during the growing season. The use of soil analyses by one of the accepted methods is a must for efficient crop production.

Rapid, accurate soil tests developed by a number of workers have proved entirely satisfactory for recommending supplementary applications of fertilizer materials and other soil amendments.

Movement of Soluble Salts in the Soil

The measurement of soluble salts in the soil has been under study for many years. It was originally applied to those soils that had a salt concentration sufficiently high to prevent plant growth. It has been applied to those soils that have been flooded with sea water and, more recently, to the inundated soils in Holland. However, while it has its value in this respect, it also has a value in determining an adequate amount of soluble salts for the crop to be grown. It is this phase of the subject that is to be developed at this time.

The measurement of the movement of soluble salts in the soil has shown that it varies with the amount and rapidity of rainfall and the soil type under investigation. This fact is of value in ascertaining the amount of supplementary application of fertilizer

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Alfalfa Regains Favor With Tennessee Farmers

*By William D. Bishop and James R. Turner**

ALFALFA is being restored to its place as "queen of forage crops" in Tennessee. Even though it suffered a tremendous setback in the State, farmers are now using this crop more extensively in their forage-crop program. From an all-time high of 183,000 acres in 1949, the acreage dropped to a low of 100,000 acres in 1952. Growers reported the decline as due to low production and the difficulty in maintaining stands, and many farmers stated that they could no longer grow alfalfa profitably. One failure of alfalfa caused more criticism and local comment than many failures with other hay crops. It was evident that alfalfa needed a helping hand.

In initiating an educational program which would provide farmers with the best information on alfalfa production, a study tour was held in April 1952. The situation in the alfalfa-producing counties visited by the study group was somewhat more alarming than many had expected to find. Even though the group found a number of factors which they felt were responsible for the short life and low production of alfalfa, the general opinion was that the factor most responsible for the short duration of stands was inadequate annual maintenance fertilizer applications, especially potash and borax.

An extensive fertilizer test demonstration program was conducted on more than 100 alfalfa fields in the major alfalfa-producing counties. The demonstrations included the use of 300 to 400 pounds of 60% muriate of potash and 20 pounds of fertilizer borate per acre applied after the first cutting. These materials were furnished by the American Potash Institute and the Pacific Coast Borax Company. The demonstrations were placed on representative areas of established fields of alfalfa with untreated alfalfa left on each side of the plot. On many fields the untreated area represented the farmer's normal fertilizer application. These plots were checked from time to time and the results recorded.

The results of the potash-borax demonstrations have done much to point out the need for annual applications of fertilizer such as 0-12-12, 0-20-20, or 0-9-27 containing borate. They have also helped to convince the farmers that alfalfa can still be grown successfully if proper fertilization and management practices are followed. As a result of the change in farmers' attitude, the number of acres of alfalfa harvested for hay in 1953 showed an increase over the previous year. Farmers are beginning to realize the value of alfalfa as a hay, silage, and pasture crop. In fact, several thousand acres of permanent pasture seedings now include alfalfa in the mixture. Further promotional and educational work is still needed, however, to restore alfalfa to its rightful place in Tennessee agriculture. The progress made thus far has been very gratifying and has given hope for even greater success in the future.

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Above: Alfalfa showing results of inadequate fertilization common on many alfalfa fields before the demonstration program started.

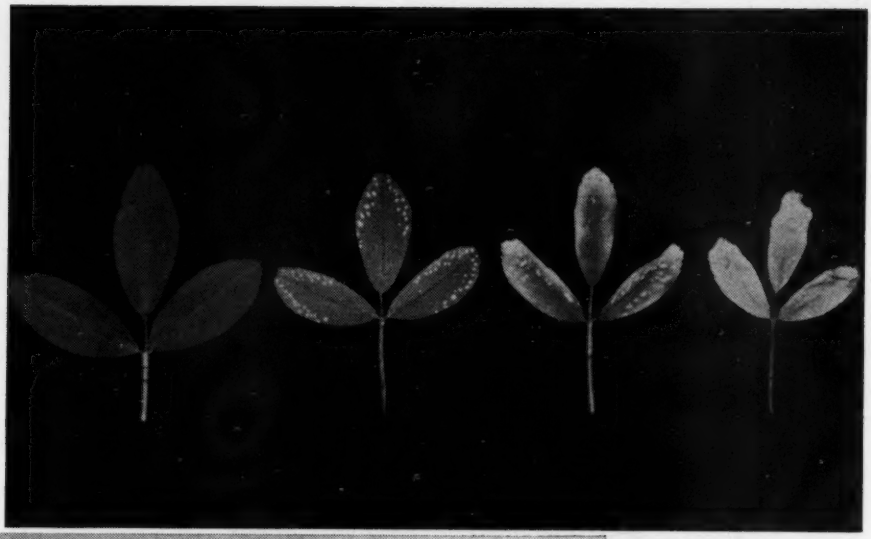
Below: Hay yields were increased one ton per acre on the treated area, right, which received 300 lbs. muriate of potash and 20 lbs. fertilizer borate per acre.

Above: Part of the group of agricultural leaders investigating alfalfa problems on the 1953 alfalfa tour.

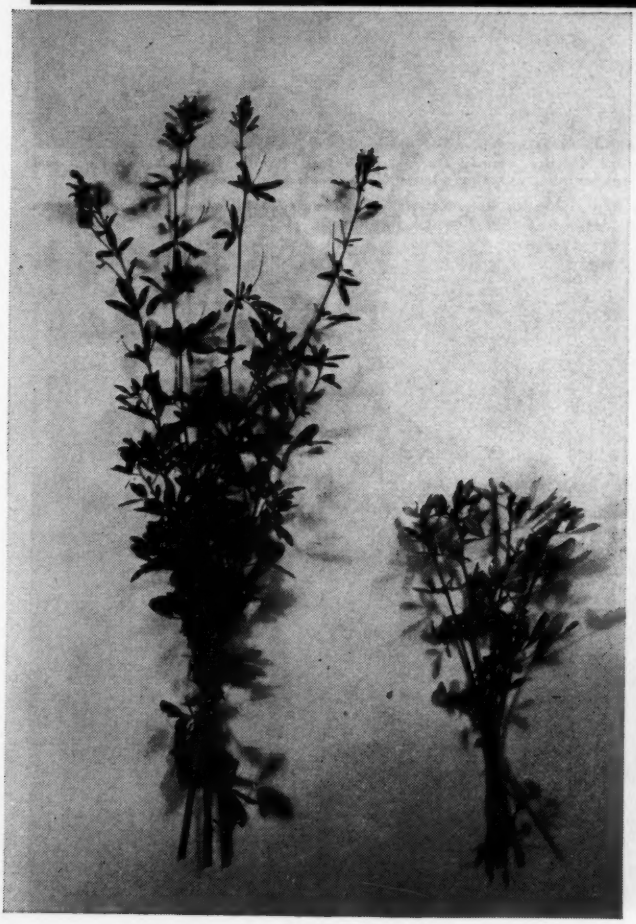
Below: This alfalfa has been fertilized according to University of Tennessee recommendations. In 1953 it produced approximately six tons of hay per acre.

Above: David Moore, Rutherford County Agent; Dr. J. A. Naftel, Pacific Coast Borax Co., and Louis Dickson, U. T. Agronomist, examine plants from treated and untreated plots.

Below: Bales representing the hay yields on the treated and untreated alfalfa on the J. B. Strawn farm in Coffee County, Tennessee.



Above: Potassium deficiency symptoms in alfalfa: (Left) Normal or healthy leaves; (Second from left) First stage of potassium deficiency indicated by white spots near margin of leaves; (Third from left) Second stage of potassium deficiency. The white spots have extended so as to entirely cover the margin, causing them to become whitish, yellow, and finally brown and dry; (Right) Advanced stage of potassium deficiency. Leaves have lost all chlorophyll and finally dry up.



Left: Alfalfa from a treated plot; (Right) no treatment. Boron deficiency symptoms in alfalfa include a stunting of the growing tip, causing a telescoping together or rosetting of the upper branches on each main stalk and an umbrella-like top growth. Flowering is checked or prevented. A yellowing or reddening of the upper leaves and a sickly and stunted appearance of the plant also develop.

The Editors Talk

Our Cover Picture

One of the brightest and most enticing of the illustrations in spring vegetable catalogs is that of carrots. But they, like the produce shown in other catalog illustrations represent specimens grown with optimum plant food and other cultural requirements. What happens when there is a shortage of potash is pictured at the left on our cover this month.

"Growth appears squat and leaves tend to bend back towards the horizontal; leaf tips, beginning with older leaves, become scorched and eventually leaves become wholly brown and die off." This is what T. Wallace in his book "The Diagnosis of Mineral Deficiencies in Plants by Visual Symptoms" has to say about the way in which carrots manifest their need for potash.

With such hindrance to growth, the roots become spindly and do not develop. Keeping quality is materially lowered. There is an instance recorded where 37.5% of carrots grown without potash rotted when stored over winter as compared to only 5.6% of those fertilized with the proper amount of potash.

Carrots have received more attention in France than in any other country. They were introduced into America during the early colonization period. While known to have been in cultivation for about 2,000 years, it is only recently they have come into the popularity which they deserve. This increase in popularity has come with the discovery of the vitamin and the fact that carrots are high in vitamin A and contain appreciable quantities of thiamine and riboflavin. They must now be included in the list of first-rank truck and garden vegetables. Acreage in this country devoted to carrots increased more than 10 times over a 20-year period, from 7,860 acres in 1923 to 79,260 in 1944. California leads in production, followed by Texas, New York, and Arizona.

Even in old textbooks, carrots are described as being "hard on the soil." They are greedy feeders on the plant-food elements, particularly potash. U. S. Department of Agriculture investigators have this to say about soil and plant-food requirements:

"Soil for carrots must be fertile and of such texture that the roots can penetrate and develop without hindrance. Moisture supply to insure germination and normal development of the crop is essential. This is often supplied, in part at least, by irrigation, the crop usually having a sufficiently high acre value to justify this practice.

"The carrot does not seem to be especially sensitive to the type of soil, so long as it is fertile, deep, and well supplied with moisture. The crop is grown on soils varying in character from light sandy loam to peat. Stiff, heavy land should be avoided, as it warms up slowly and also interferes with the germination of the seed and the development of the roots. Carrots from stiff or stony land are likely to be rough and unfit for the market. Irrespective of its type, the land selected should be capable of being plowed to a depth of not less than 8 and preferably 10 to 12 inches."

Regarding the use of fertilizers, they say:

"The carrot is a heavy feeder and has the reputation of being hard on the land. On muck and peat very liberal use should be made of potash. Experimental work carried on by the Division of Fruit and Vegetable Crops and Diseases with carrots on peat shows that applications of 500 to 600 pounds of muriate of potash per acre usually give profitable results. No general rule for the use of fertilizers can be given, but a broadcast application of from 1,000 to 2,000 pounds per acre of a mixture containing 5 to 6 per cent of nitrogen, 6 to 8 per cent of phosphoric acid, and 12 to 16 per cent of potash is generally sufficient."

The Home Market

Paramount in most agricultural discussions and publicity these days is a farm program which will assure reasonable prosperity to the farmer and do away with burdensome surpluses. Pros and cons on this and that issue are being aired, signifying the diversity of opinion of the various interests. Aside from the argumentative pitch, many of the talks and articles contain facts which call for pause and consideration on how we are living. Such information is to be found in an address by Secretary of Agriculture Ezra Taft Benson before several groups in New York recently.

In discussing markets, the Secretary pointed out that while the export market is important, the big market for agriculture is right here at home. With a population that has recently been increasing by more than 2½ million every year, we have here a market that is only partly tapped. The experience with beef last year proved that. Aggressive marketing and cooperation between agriculture, industry, and government raised consumption to an all-time high of about 75 pounds per person.

"In a recent year, the average city family ate 2.4 pounds of meat per person per week. But 20 per cent of city families that same year ate less than 1½ pounds of meat per person per week. That's what I mean when I say the market at home is only partly tapped," the Secretary said.

"So far as averages are concerned, the diet of the American people looks pretty good. But we know that our people and our doctors are becoming increasingly concerned about obesity. In many cases, this means that some people are eating too much of the wrong kinds of food.

"We know also that many families have diet deficiencies. In 1948, for example, 29 per cent of all city families were using less than a pint of milk or its equivalent per person per day. Adults should have at least a pint a day; children and pregnant and nursing mothers should have a quart. Adolescents need plenty of milk; yet we know that teen-age girls often skimp on milk, falsely thinking this is necessary to be slender. Milk is a great source of calcium."

One out of five families in the Nation had less than adequate amounts of ascorbic acid, thiamine, riboflavin, and niacin. All of these are essential to good nutrition. Citrus fruits and tomatoes are fine sources of ascorbic acid. Almost one-third of the city families in the spring of 1948 were using less than two pounds of citrus fruit and tomatoes per person per week. At least 2¼ pounds are recommended. Thirty per cent of the city families were using fewer than five eggs per person per week.

"Some of these dietary deficiencies are due, of course, to low incomes," the Secretary said. "We know that those families whose incomes rose relatively between 1942 and 1948 bought more milk, meat, poultry, fish, and citrus fruit. Prosperity is the greatest market expander of all. And we *must* all work together to maintain prosperity."

Season Average Prices Received by Farmers for Specified Commodities *

Crop Year	Cotton Cents per lb. Aug.-July	Tobacco Cents per lb.	Potatoes Cents per bu. July-June	Sweet Potatoes Cents per bu. July-June	Corn Cents per bu. Oct.-Sept.	Wheat Cents per bu. July-June	Hay [1] Dollars per ton July-June	Cottonseed Dollars per ton July-June	Truck Crops ....
Av. Aug. 1909–July 1914....	12.4	10.0	69.7	87.8	64.2	88.4	11.87	22.55	....
1928.....	18.0	20.0	53.2	118.0	84.0	99.8	11.22	34.17	....
1929.....	16.8	18.3	131.6	117.1	79.9	103.6	10.90	30.92	....
1930.....	9.5	12.8	91.2	108.1	59.8	67.1	11.06	22.04	....
1931.....	5.7	8.2	46.0	72.6	32.0	39.0	8.69	8.97	....
1932.....	6.5	10.5	38.0	54.2	31.9	38.2	6.20	10.33	....
1933.....	10.2	13.0	82.4	69.4	52.2	74.4	8.09	12.88	....
1934.....	12.4	21.3	44.6	79.8	81.5	84.8	13.20	33.00	....
1935.....	11.1	18.4	59.3	70.3	65.5	83.2	7.52	30.54	....
1936.....	12.4	23.6	114.2	92.9	104.4	102.5	11.20	33.36	....
1937.....	8.4	20.4	52.9	78.0	51.8	96.2	8.74	19.51	....
1938.....	8.6	19.6	55.7	69.8	48.6	56.2	6.78	21.79	....
1939.....	9.1	15.4	69.7	73.4	56.8	69.1	7.94	21.17	....
1940.....	9.9	16.0	54.1	85.4	61.8	68.2	7.59	21.73	....
1941.....	17.0	26.4	80.8	92.2	75.1	94.4	9.70	47.65	....
1942.....	19.0	36.9	117.0	118.0	91.7	110.0	10.80	45.61	....
1943.....	19.9	40.5	131.0	206.0	112.0	136.0	14.80	52.10	....
1944.....	20.7	42.0	150.0	190.0	109.0	141.0	16.50	52.70	....
1945.....	22.5	36.6	143.0	204.0	127.0	150.0	15.10	51.10	....
1946.....	32.6	38.2	124.0	218.0	156.0	191.0	16.70	72.00	....
1947.....	31.9	38.0	162.0	217.0	216.0	229.0	17.60	85.90	....
1948.....	30.4	48.2	155.0	222.0	129.0	200.0	18.45	67.20	....
1949.....	28.6	45.9	128.0	214.0	124.0	188.0	16.50	43.40	....
1950.....	40.1	51.7	91.7	173.0	153.0	200.0	16.70	86.50	....
1951.....	37.9	51.1	163.0	304.0	166.0	211.0	19.50	69.30	....
1952.....	36.9	50.0	196.0	331.0	157.0	209.0	21.05	70.00	....
1953									
February.....	30.19	36.7	179.0	384.0	143.0	205.0	20.85	64.50	....
March.....	31.52	....	165.0	401.0	146.0	210.0	19.65	63.60	....
April.....	31.45	....	134.0	409.0	146.0	208.0	18.85	63.10	....
May.....	31.73	51.5	115.0	413.0	149.0	206.0	17.95	61.80	....
June.....	31.51	51.0	102.0	398.0	146.9	188.0	16.05	61.20	....
July.....	31.87	51.2	95.5	402.0	147.0	187.0	15.45	59.00	....
August.....	32.77	51.3	91.4	350.0	148.0	186.0	15.85	56.70	....
September...	33.09	57.6	98.9	264.0	150.0	192.0	16.15	51.50	....
October.....	32.46	52.6	89.7	233.0	134.0	194.0	16.45	52.40	....
November...	31.82	42.3	83.4	232.0	133.0	200.0	17.25	53.40	....
December....	30.73	49.2	69.9	246.0	141.0	201.0	18.25	53.00	....
1954									
January.....	30.05	48.3	69.1	253.0	142.0	203.0	19.05	52.00	....
Index Numbers (Aug. 1909—July 1914 = 100)									
1928.....	145	200	76	134	131	113	95	152	154
1929.....	135	183	189	133	124	117	92	137	137
1930.....	77	128	131	123	93	76	93	98	129
1931.....	46	82	66	83	50	44	73	40	115
1932.....	52	105	55	62	50	43	52	46	102
1933.....	82	130	118	79	81	84	68	57	91
1934.....	100	213	64	91	127	96	111	146	95
1935.....	90	184	85	80	102	94	63	135	119
1936.....	100	236	164	106	163	116	94	148	104
1937.....	68	204	76	89	81	109	74	87	110
1938.....	69	196	80	79	76	64	57	97	88
1939.....	73	154	100	84	88	78	67	94	91
1940.....	80	160	78	97	96	77	64	96	111
1941.....	137	264	116	105	117	107	82	211	129
1942.....	153	369	168	134	143	124	91	202	163
1943.....	160	405	188	235	174	154	125	231	245
1944.....	167	420	214	216	170	160	139	234	212
1945.....	181	366	205	232	198	170	127	227	207
1946.....	263	382	178	248	212	209	141	319	182
1947.....	257	380	232	248	336	259	148	381	226
1948.....	245	482	222	253	201	226	155	298	214
1949.....	231	459	184	244	193	213	139	192	201
1950.....	323	517	132	197	238	226	141	384	185
1951.....	306	512	233	346	259	239	164	307	239
1952.....	298	500	281	377	245	236	177	310	254
1953									
February....	243	367	257	437	223	232	176	286	237
March.....	254	...	237	457	227	238	166	282	248
April.....	254	...	192	466	227	235	159	280	204
May.....	256	515	165	470	232	233	151	274	182
June.....	254	510	146	453	227	213	138	271	270
July.....	257	512	137	458	229	212	130	262	216
August.....	264	513	131	399	231	210	134	251	221
September...	267	576	142	301	234	217	136	228	159
October.....	262	526	129	265	209	219	139	232	175
November...	257	423	120	264	207	226	145	237	186
December....	248	492	100	280	220	227	154	235	195
1954									
January.....	242	483	99	288	221	230	160	231	....

Wholesale Prices of Phosphates and Potash **

	Superphosphate, Baltimore, per unit	Florida land pebble, 68% f.o.b. mines, bulk, per ton	Tennessee phosphate rock, 75% f.o.b. mines, bulk, per ton	Muriate of potash bulk, per unit, c.i.f. Atlantic and Gulf ports [2]	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports [2]	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports [2]	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports [2]
1910–14	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657
1928	.580	3.12	5.50	.669	.957	26.46	.607
1929	.609	3.18	5.50	.672	.962	26.59	.610
1930	.542	3.18	5.50	.681	.973	26.92	.618
1931	.485	3.18	5.50	.681	.973	26.92	.618
1932	.458	3.18	5.50	.681	.963	26.90	.618
1933	.434	3.11	5.50	.662	.864	25.10	.601
1934	.487	3.14	5.67	.486	.751	22.49	.483
1935	.492	3.30	5.69	.415	.684	21.44	.444
1936	.476	1.85	5.50	.464	.708	22.94	.505
1937	.510	1.85	5.50	.508	.757	24.70	.556
1938	.492	1.85	5.50	.523	.774	15.17	.572
1939	.478	1.90	5.50	.521	.751	24.52	.570
1940	.516	1.90	5.50	.517	.730	24.75	.573
1941	.547	1.94	5.64	.522	.780	25.55	.367
1942	.600	2.13	6.29	.522	.810	25.74	.205
1943	.631	2.00	5.93	.522	.786	25.35	.195
1944	.645	2.10	6.10	.522	.777	25.35	.195
1945	.650	2.20	6.23	.522	.777	25.35	.195
1946	.671	2.41	6.50	.508	.769	24.70	.190
1947	.746	3.05	6.60	.432	.706	18.93	.195
1948	.764	4.27	6.60	.397	.681	14.14	.195
1949	.770	3.88	6.22	.397	.703	14.14	.195
1950	.763	3.83	5.47	.371	.716	14.33	.195
1951	.813	3.98	5.47	.401	.780	15.25	.200
1952	.849	3.98	5.47	.401	.793	15.25	.200
1953							
February	.860	3.98	5.47	.430	.827	16.00	.210
March	.860	4.22	5.47	.430	.827	16.00	.210
April	.860	4.28	....	.430	.827	16.00	.210
May	.860	4.28	....	.430	.827	16.00	.210
June	.860	4.28	....	.361	.708	13.44	.176
July	.895	4.28	....	.396	.768	14.72	.193
August	.895	....	.. .	.396	.768	14.72	.193
September	.895	....	....	.396	.768	14.72	.193
October	.895	....	....	.396	.768	14.72	.193
November	.895	....	....	.396	.768	14.72	.193
December	.895	....	....	.430	.827	16.00	.210
1954							
January	.895	....	....	.430	.827	16.00	.210
Index Numbers (1910-14 = 100)							
1928	108	86	113	94	100	109	92
1929	114	88	113	94	101	110	93
1930	101	88	113	95	102	111	94
1931	90	88	113	95	102	111	94
1932	85	88	113	95	101	111	94
1933	81	86	113	93	91	104	91
1934	91	87	110	68	79	93	74
1935	92	91	117	58	72	89	68
1936	89	51	113	65	74	95	77
1937	95	51	113	71	79	102	85
1938	92	51	113	73	81	104	87
1939	89	53	113	73	79	101	87
1940	96	53	113	72	77	102	87
1941	102	54	110	73	82	106	87
1942	112	59	129	73	85	106	84
1943	117	55	121	73	82	105	83
1944	120	58	125	73	82	105	83
1945	121	61	128	73	82	105	83
1946	125	67	133	71	81	102	82
1947	139	84	135	70	74	78	83
1948	143	118	135	67	72	58	83
1949	144	108	128	67	74	58	83
1950	142	106	112	68	75	59	83
1951	152	110	112	72	82	63	83
1952	158	110	112	72	83	63	83
1953							
February	160	110	112	76	87	66	85
March	160	117	112	76	87	66	85
April	160	119	...	76	87	66	85
May	160	119	...	76	87	66	85
June	160	119	...	66	74	56	80
July	167	119	...	71	81	61	82
August	167	...	...	71	81	61	82
September	167	...	...	71	81	61	82
October	167	...	...	71	81	61	82
November	167	...	...	71	81	61	82
December	167	...	...	76	87	66	85
1954							
January	167	...	...	76	87	66	85

Wholesale Prices of Ammoniates **

	Nitrate of soda bulk per unit N	Sulphate of ammonia bulk per unit N	Cottonseed meal S. E. Mills per unit N	Fish scrap, dried 11–12% ammonia, 15% bone phosphate, f.o.b. factory bulk per unit N	Tankage 11% ammonia, 15% bone phosphate, f.o.b. Chicago, bulk, per unit N	High grade ground blood, 16–17% ammonia, Chicago, bulk, per unit N
1910–14	$2.68	$2.85	$3.50	$3.53	$3.37	$3.52
1928	2.67	2.30	7.06	6.63	4.92	6.00
1929	2.57	2.04	5.64	5.00	4.61	5.72
1930	2.47	1.81	4.78	4.96	3.79	4.58
1931	2.34	1.46	3.10	3.95	2.11	2.46
1932	1.87	1.04	2.18	2.18	1.21	1.36
1933	1.52	1.12	2.95	2.86	2.06	2.46
1934	1.52	1.20	4.46	3.15	2.67	3.27
1935	1.47	1.15	4.59	3.10	3.06	3.65
1936	1.53	1.23	4.17	3.42	3.58	4.25
1937	1.63	1.32	4.91	4.66	4.04	4.80
1938	1.69	1.38	3.69	3.76	3.15	3.53
1939	1.69	1.35	4.02	4.41	3.87	3.90
1940	1.69	1.36	4.64	4.36	3.33	3.39
1941	1.69	1.41	5.50	5.32	3.76	4.43
1942	1.74	1.41	6.11	5.77	5.04	6.76
1943	1.75	1.42	6.30	5.77	4.86	6.62
1944	1.75	1.42	7.68	5.77	4.86	6.71
1945	1.75	1.42	7.81	5.77	4.86	6.71
1946	1.97	1.44	11.04	7.38	6.60	9.33
1947	2.50	1.60	12.72	10.66	12.63	10.46
1948	2.86	2.03	12.94	10.59	10.84	9.85
1949	3.15	2.29	10.11	13.18	10.73	10.62
1950	3.00	1.95	11.01	11.70	10.21	9.36
1951	3.16	1.97	13.20	10.92	10.18	10.09
1952	3.34	2.09	13.95	11.27	9.72	9.16
1953						
February	3.34	2.28	13.21	11.24	7.75	7.28
March	3.34	2.28	12.69	11.24	7.16	6.56
April	3.34	2.28	11.75	11.24	6.07	6.00
May	3.34	2.28	10.34	11.24	6.23	6.14
June	3.34	2.28	10.61	11.26	6.62	6.31
July	3.34	2.28	10.34	11.15	6.75	6.14
August	3.34	2.28	10.14	10.95	7.53	6.68
September	3.09	2.28	9.82	11.04	7.51	6.91
October	3.09	2.25	9.73	11.24	7.96	7.75
November	3.09	2.22	9.61	11.24	8.19	8.19
December	3.09	2.22	10.96	11.24	8.50	9.03
1954						
January	3.09	2.22	11.28	11.24	9.26	9.71
Index Numbers (1910-14 = 100)						
1928	100	81	202	188	146	170
1929	96	72	161	142	137	162
1930	92	64	137	141	112	130
1931	88	51	89	112	63	70
1932	71	36	62	62	36	39
1933	59	39	84	81	97	71
1934	59	42	127	89	79	93
1935	57	40	131	88	91	104
1936	59	43	119	97	106	131
1937	61	46	140	132	120	122
1938	63	48	105	106	93	100
1939	63	47	115	125	115	111
1940	63	48	133	124	99	96
1941	63	49	157	151	112	126
1942	65	49	175	163	150	192
1943	65	50	180	163	144	189
1944	65	50	219	163	144	191
1945	65	50	223	163	144	191
1946	74	51	315	209	196	265
1947	93	56	363	302	374	297
1948	107	71	370	300	322	280
1949	117	80	289	373	318	302
1950	112	68	315	331	303	266
1951	118	69	377	310	302	287
1952	125	74	399	319	288	260
1953						
February	125	80	378	318	230	207
March	125	80	363	318	212	186
April	125	80	336	318	180	170
May	125	80	295	318	185	174
June	125	80	303	319	196	179
July	125	80	295	316	200	174
August	125	80	290	310	223	190
September	115	80	281	313	223	196
October	115	79	278	318	236	220
November	115	78	275	318	243	233
December	115	78	313	318	252	257
1954						
January	115	78	322	318	275	276

Combined Index Numbers of Prices of Fertilizer Materials, Farm Products and all Commodities

	Farm prices*	Prices paid by farmers for commodities bought*	Wholesale prices of all commodities†	Fertilizer material‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash**
1928.....	149	152	141	121	87	177	108	97
1929.....	148	150	139	114	79	146	114	97
1930.....	125	140	126	105	72	131	101	99
1931.....	87	119	107	83	62	83	90	99
1932.....	65	102	95	71	46	48	85	99
1933.....	70	104	96	70	45	71	81	95
1934.....	90	118	109	72	47	90	91	72
1935.....	109	123	117	70	45	97	92	63
1936.....	114	123	118	73	47	107	89	69
1937.....	122	130	126	81	50	129	95	75
1938.....	97	122	115	78	52	101	92	77
1939.....	95	121	112	79	51	119	89	77
1940.....	100	122	115	80	52	114	96	77
1941.....	123	130	127	86	56	130	102	77
1942.....	158	149	144	93	57	161	112	77
1943.....	192	165	151	94	57	160	117	77
1944.....	196	174	152	96	57	174	120	76
1945.....	206	180	154	97	57	175	121	76
1946.....	234	197	177	107	62	240	125	75
1947.....	275	231	222	130	74	362	139	72
1948.....	285	250	241	134	89	314	143	70
1949.....	249	240	226	137	99	319	144	70
1950.....	256	246	232	132	89	314	142	72
1951.....	302	271	258	139	93	331	152	76
1952.....	288	273	251	144	98	333	158	76
1953								
February..	263	264	246	142	102	296	160	80
March....	264	265	248	141	102	282	160	80
April.....	259	264	246	139	102	256	160	80
May.....	261	264	247	137	102	245	160	80
June.....	259	260	246	135	102	253	160	70
July.....	259	261	248	138	102	252	167	75
August....	258	262	249	139	102	261	167	75
September.	256	259	249	137	97	258	167	75
October...	250	258	248	137	96	265	167	75
November.	249	259	247	137	96	267	167	75
December..	254	260	248	141	96	285	167	80
1954								
January...	259	263	250	142	96	300	167	80

* U. S. D. A. figures, revised January 1950. Beginning January 1946 farm prices and index numbers of specific farm products revised from a calendar year to a crop-year basis. Truck crops index adjusted to the 1924 level of the all-commodity index.

† Department of Labor index converted to 1910-14 base.

‡ The Index numbers of prices of fertilizer materials are based on original study made by the Department of Agricultural Economics and Farm Management, Cornell University, Ithaca, New York. These indexes are complete since 1897. The series was revised and reweighted as of March 1940 and November 1942.

[1] Beginning July 1949, baled hay prices reduced by $4.75 a ton to be comparable to loose hay prices previously quoted.

[2] All potash salts now quoted F.O.B. mines only; manure salts since June 1941, other carriers since June 1947.

**** Where range of prices for fertilizer material is quoted, average figure is used. The weighted average of prices actually paid for potash is lower than the annual average because since 1926 over 90% of the potash used in agriculture has been contracted for during the discount period. The maximum discount is now 16%. Applied to muriate of potash, a price slightly above $.353 per unit K_2O thus more nearly approximates the annual average than do prices based on arithmetical averages of monthly quotations.**

REVIEWS

This section contains a short review of some of the most practical and important bulletins, and lists all recent publications of the United States Department of Agriculture, the State Experiment Stations, and Canada, relating to Fertilizers, Soils, Crops, and Economics. A file of this department of BETTER CROPS WITH PLANT FOOD would provide a complete index covering all publications from these sources on the particular subjects named.

Fertilizers

"Recommended Fertilizers and Nutritional Sprays for Citrus," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., Bul. 536, Jan. 1954, H. J. Reitz, C. D. Leonard, J. W. Sites, W. F. Spencer, I. Stewart, and I. W. Wander.

"Phosphate Fertilizers," Agr. Exp. Sta., Miss. State College, State College, Miss., Bul. 503, Sept. 1953, U. S. Jones.

"Fertilizer Inspection and Analysis; Fall, 1952, Including Fertilizer Tonnage Data," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Bul. 602, July 1953, J. H. Longwell, R. C. Prewitt, C. W. Gehrke, and E. W. Cowan.

"Nitrogen In Forage Production," Agr. Exp. Sta., N. C. State College, Raleigh, N. C., Bul. 383, Sept. 1953, W. W. Woodhouse, Jr., and D. S. Chamblee.

"Lime and Fertilizer Pay Off," Agr. Exp. Sta., N. C. State College, Raleigh, N. C., Bul. 385, Dec. 1953, W. L. Nelson.

"Fertilizer Recommendations," Agr. Ext. Serv., N. C. State College, Raleigh, N. C.

"Effects of Soil Fertility Levels on the Quality of Fresh and Processed Tomatoes, Sweet Corn, Cabbage," Agr. Exp. Sta., Wooster, Ohio, Res. Bul. 738, Dec. 1953, H. D. Brown, G. Davis, I. C. Hoffman, R. B. Davis, J. Bushnell, and D. Wilson.

"A Study of Phosphate Fertilization and Legume Rotations for Small-Grain Winter Pastures," Agr. Exp. Sta., Okla. A.&M. College, Stillwater, Okla., Bul. B-414, Dec. 1953, H. J. Harper.

"Results of Small Grain Fertilizer Demonstrations in Oklahoma—1953," Ext. Div., Okla. A.&M. College, Stillwater, Okla., Cir. 607, G. Hanes, W. Chaffin, and R. O. Woodward.

"The Effect of Nitrogen on the Yield of Old Established Pastures," Agr. Exp. Sta., State College of Wash., Puyallup, Wash., Sta. Cir. 225, July 1953, F. R. Murdock and A. S. Hodgson.

"A Review of Phosphate Fertilizer Investigations in 15 Western States Through 1949," USDA, Wash., D. C., Cir. 927, Oct. 1953, H. B. Peterson, L. B. Nelson, and J. L. Paschal.

Soils

"Sprinkler Irrigation," Agr. Exp. Sta., Univ. of Ariz., Tucson, Ariz., Bul. 250, Oct. 1953, H. C. Schwalken, K. R. Frost, and W. W. Hinz.

"Physical, Spectrographic and Chemical Analyses of Some Virgin Florida Soils," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., Bul. 524, Aug. 1953, N. Gammon, Jr., J. R. Henderson, R. A. Carrigan, R. E. Caldwell, R. G. Leighty, and F. B. Smith.

"Soil Survey, Graham County, North Carolina," USDA, SCS, Wash., D. C., Series 1942, No. 1, Aug. 1953, E. F. Goldston and W. Gettys.

"Our Productive Land . . . We Can Conserve and Improve It While Using It," USDA, SCS, Wash., D. C., Agr. Inf. Bul. 106, July 1953.

"Conquest of the Land through 7,000 Years," USDA, SCS, Wash., D. C., Agr. Inf. Bul. 99, Aug. 1953, W. C. Lowdermilk.

"Irrigation-Enterprise Organizations," US DA, SCS and BAE, Wash., D. C., Cir. 934, Oct. 1953, W. A. Hutchins, H. E. Selby, and S. W. Voelker.

"Agricultural Conservation Program, Summary 1952," USDA, Agr. Conservation Program Serv., Wash., D. C., Rpts. Control No. ACP-15P, Nov. 1953.

"Agricultural Conservation Program Handbook for 1954" for: Ariz., Ark., Del., Hawaii, Fla., Ind., Kansas, Md., Mass., Minn., Miss., Mont., Nebr., Nev., N. Y., N. C., Ohio, Okla., Ore., Pa., R. I., S. C., S. Dak., Tenn., Tex., Utah, Vt., Va., Wash., and W. Va.; USDA, Wash., D. C.

Crops

"Rootstocks for Stone Fruits," Agr. Exp. Sta., Univ. of Calif., Davis, Calif., Bul. 736, June 1953, L. H. Day.

"Progress Report 1948-1952, District Experiment Substation Fort William and Illustration Stations at Dryden, Kenora, Emo, and Fort Frances in Northwestern Ontario," Dept. of Agr., Exp. Farms Serv., Ottawa, Ontario, Nov. 1953, J. K. Knights.

"Oat Varieties, Past and Present," Dept. of Agr., Ottawa, Ontario, Pub. 891, June 1953, J. N. Welsh, R. B. Carson, W. J. Cherewick, W. A. F. Hagborg, B. Peturson, and H. A. H. Wallace.

"Hedges for Canadian Gardens," Dept. of Agr., Exp. Farms Serv., Ottawa, Ontario, Pub. 899, Nov. 1953, R. W. Oliver.

"Miniature Potted Trees," Agr. Ext. Serv., Univ. of Conn., Storrs, Conn., Lflt. 37, March 1953, H. O. Perkins.

"Annual Report 1952-1953, State Board of Agriculture, for Quarter Ended September 30, 1953," State Board of Agr., Dover, Del. Vol. 43, No. 3.

"Bush Snap Bean Production on the Sandy Soils of Florida," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., Bul. 530, Nov. 1953, W. A. Hills, J. F. Darby, W. H. Thames, Jr., and W. T. Forsee, Jr.

"Flue-Cured Tobacco Culture in Georgia," Agr. Ext. Serv., Univ. of Ga., Athens, Ga., Bul. 579, Sept. 1953, E. C. Westbrook.

"Evaluating Pasture Forages with Dairy Cows—Techniques and Problems Encountered," Ga. Exp. Sta., Experiment, Ga., Mimeo. Series 58, July 1952, M. E. McCullough and O. E. Sell.

"The Suitability and Utilization of Winter Forages for Dairy Cattle," Ga. Exp. Sta., Experiment, Ga., Mimeo. Series 62, Jan. 1953, M. E. McCullough, W. E. Neville, Jr., and O. E. Sell.

"Effects of Grass Competition Upon the Establishment of Hardwood Plantations in Iowa," Agr. Exp. Sta., Iowa State College, Ames, Iowa, Res. Bul. 399, Aug. 1953, R. D. Lane and A. L. McComb.

"Guide to Higher Soybean Yields," Agr. Ext. Serv., Iowa State College, Ames, Iowa, Pam. 202, May 1953, C. R. Weber.

"Research in Agriculture, Annual Report 1951-52," Agr. Exp. Sta., Univ. of La., Baton Rouge, La., May 1953, I. L. Forbes.

"1954 Crop and Fertilizer Recommendations for Mississippi," Agr. Exp. Sta., Miss. State College, State College, Miss., Cir. 187, Oct. 1953.

"Seeding in Permanent Pasture for Supplementary Winter Grazing," Agr. Exp. Sta., Miss. State College, State College, Miss., Bul. 505, Oct. 1953, R. F. Dudley and L. N. Wise.

"Potato Production in New York State," Agr. Ext. Serv., Cornell Univ., Ithaca, N. Y., Bul. 890.

"The Culture of Garden Chrysanthemums," Agr. Ext. Serv., Cornell Univ., Ithaca, N. Y., Bul. 894, June 1953, R. E. Lee.

"The Culture of Iris," Agr. Ext. Serv., Cornell Univ., Ithaca, N. Y., Bul. 895, June 1953, L. H. MacDaniels.

"The Culture of Spring Flowering Bulbs," Agr. Ext. Serv., Cornell Univ., Ithaca, N. Y., Bul. 896, June 1953, R. E. Lee.

"Dorman Soybeans for Oklahoma," Agr. Exp. Sta., Okla. A.&M. College, Stillwater, Okla., Bul. B-413, Dec. 1953, R. S. Matlock.

"How New Crop Varieties Reach Growers," Agr. Exp. Sta., Okla. A.&M. College, Stillwater, Okla., Misc. Pub. No. MP-32, Dec. 1953.

"Performance Tests of Corn Varieties and Hybrids, 1953," Agr. Exp. Sta., Okla. A.&M. College, Stillwater, Okla., Misc. Pub. MP-33, Jan. 1954, H. Pass, J. S. Brooks, and J. W. Smith.

"Irish Potato Variety and Strain Test in the Lower Rio Grande Valley, Spring 1953," Agr. Exp. Sta., Texas A.&M. College, College Station, Texas, Prog. Rpt. 1624, Oct. 28, 1953, P. W. Leeper, R. T. Correa, and W. R. Cowley.

"Christmas Trees in Northeast Texas," Agr. Exp. Sta., Texas A.&M. College, College Station, Texas, Prog. Rept. 1625, Nov. 2, 1953, H. F. Morris.

"Yield and Chemical Composition of Crops Grown for Forage at Mt. Pleasant, 1950-52," Agr. Exp. Sta., Texas A.&M. College, College Station, Texas, Prog. Rpt. 1626, Nov. 2, 1953, M. Buckingham, R. C. Potts, and C. L. Godfrey.

"Apple Varieties in Northeast Texas," Agr. Exp. Sta., Texas A.&M. College, College Station, Texas, Prog. Rpt. 1627, Nov. 2, 1953, H. F. Morris.

"Ness Berry Production in East Texas," Agr. Exp. Sta., Texas A.&M. College, College Station, Texas, Prog. Rpt. 1631, Dec. 8, 1953, H. F. Morris.

"Cotton Variety Test at Batesville, 1953," Agr. Exp. Sta., Texas A.&M. College, College Station, Texas, Prog. Rpt. 1632, Dec. 10, 1953, C. S. Hoveland.

"Sugar Beet Yield and Quality As Affected by Plant Population, Soil Moisture Condition and Fertilization," Agr. Exp. Sta., Utah State Agr. College, Logan, Utah, Bul. 362, Aug. 1953, J. L. Haddock.

"Comparison of Sun-Cured and Barn-Cured Hay from the Same Field," Agr. Exp. Sta., Univ. of Vt., Burlington, Vt., Bul. 574, Nov. 1953, O. M. Camburn and C. H. Jones.

"Winter Pastures with Cover Crops," Agr. Ext. Serv., Va. Polytechnic Inst., Blacksburg, Va., Cir. 505, Rev. Sept. 1953.

"Seasonal Changes in Florida Temple Oranges," USDA, Wash., D. C., Tech. Bul. 1072, Oct. 1953, P. L. Harding and M. B. Sunday.

"Farm Forestry Extension, What It Is and How It Works," Agr. Ext. Serv., USDA, Wash., D. C., Agr. Inf. Bul. No. 107, Nov. 1953, W. K. Williams.

Economics

"Should I Buy A Citrus Grove?," Agr. Ext. Serv., Univ. of Fla., Gainesville, Fla., Cir. 119, Oct. 1953, Z. Savage.

"Economic Study of Farming in the Plant City Area, Hillsborough County, Florida," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., Bul. 533, Dec. 1953, R. E. L. Greene.

"Twenty-One Years of Citrus Costs and Returns in Florida, 1931-1952, Agr. Ext. Serv., Univ. of Fla., Gainesville, Fla., AE Series No. 54-7, Dec. 1953, Z. Savage.

"Corn Production Practices and Costs in Three Areas of Georgia," Ga. Exp. Sta., Experiment, Ga., Mimeo. Series 56, Nov. 1952, J. C. Elrod and W. T. Fullilove.

"Annual Lespedeza Production Practices and Costs in the Piedmont of Georgia," Ga. Exp. Sta., Experiment, Ga., Mimeo. Series 57, Aug. 1952, C. C. Taylor and J. C. Elrod.

"Sweet Potatoes: Production Practices and Costs in the Coastal Plain of Georgia," Ga. Exp. Sta., Experiment, Ga., Mimeo. Series 59, Oct. 1952, J. V. Minchew.

"Snap Beans: Production Practices and Costs in the Mountain Area of Georgia," Ga. Exp. Sta., Experiment, Ga., Mimeo. Series 60, Nov. 1952, J. R. Russell and J. C. Elrod.

"Irish Potatoes: Production Practices and Costs in the Mountain Area of Georgia," Ga. Exp. Sta., Experiment, Ga., Mimeo. Series 61, Dec. 1952, J. R. Russell.

"Pole Beans: Production Practices and Costs in the Mountain Area, Georgia," Ga. Exp. Sta., Experiment, Ga., Mimeo. Series 64, Jan. 1953, J. R. Russell.

"Cabbage: Production Practices and Costs in the Mountain Area, Georgia," Ga. Exp. Sta., Experiment, Ga., Mimeo. Series 65, March 1953, J. R. Russell.

"Bell Pepper: Production Practices and Costs in the Mountain Area, Georgia," Ga. Exp. Sta., Experiment, Ga., Mimeo. Series 67, Aug. 1953, J. R. Russell and J. C. Elrod.

"North Carolina Agricultural Statistics," N. C. Dept. of Agr., Raleigh, N. C., 1953 issue.

"Time to Sell? Corn & Soybeans," Agr. Ext. Serv., Raleigh, N. C., J. Curtis.

"Oklahoma Land Market Activity, 1945-1952," Agr. Exp. Sta., Okla. A.&M. College, Stillwater, Okla., Bul. B-412, Nov. 1953, R. L. Tontz.

"An Economic Analysis of Land Clearing and Subsequent Crop Production in the Corpus Christi Area," Agr. Exp. Sta., Texas A.&M. College, College Station, Texas, Prog. Rpt. 1628, R. H. Rogers and J. R. Campbell.

"Timely Economic Information, Columbia Basin Project—1952," Agr. Exp. Sta., State College of Wash., Pullman, Wash., Sta. Cir. No. 219, April 1953, M. H. Steinmueller.

"Report of the Manager of the Federal Crop Insurance Corporation, 1953," USDA, Wash., D. C., Oct. 16, 1953.

"Report of the Administrator of the Farmers Home Administration 1953—Developing the Resources of Family Farms," USDA, Wash., D. C., Sept. 15, 1953.

"Report of the Solicitor to the Secretary of Agriculture, 1953," USDA, Wash., D. C., Sept. 16, 1953.

"Report of the Chief of the Office of Experiment Stations, 1953," USDA, Wash., D. C., Sept. 1, 1953.

"Report of the Chief of the Forest Service, 1953—Grazing on the National Forests," USDA, Wash., D. C., Sept. 15, 1953.

"Report of the Federal Experiment Station in Puerto Rico, 1953," Federal Exp. Sta., Mayaguez, Puerto Rico, Oct. 1953.

"Report of Activities Under the Agricultural Marketing Act, 1953," USDA, Wash., D. C., Oct. 15, 1953.

"Report of the President of the Commodity Credit Corporation, 1953," USDA, Wash., D. C., Oct. 15, 1953.

"Highlights of Potato Marketing," USDA, Wash., D. C., Agr. Inf. Bul. 114, Oct. 1953, A. C. Cook.

"1954 Vegetable Guides Program—Spring Vegetables for Fresh Market and Early Commercial Potatoes, USDA, Wash., D. C., Nov. 1953.

"Dairy Statistics and Related Series," USDA, Wash., D. C., Stat. Bul. 134, Oct. 1953.

"Cotton Linters, Production, Marketing, and Market Outlets, USDA, Wash., D. C., Marketing Research Rpt. 56, Nov. 1953.

"Price Programs of the United States Department of Agriculture," USDA, Wash., D. C., Agr. Inf. Bul. 13, Rev. Dec. 1953.

Dimples: "I said some very foolish things to my boy-friend last night."

Girl Friend: "Yes?"

Dimples: "That was one of them."

Girl's Father: 'Young man, we turn the light off around here at 10:30."

Boy: "That's okay sir. We won't be reading."

Fertilizer Influences Vitamin Content of Tomatoes

A PROJECT at the Ohio Agricultural Experiment Station proved that lack of certain fertilizing elements in the soil will affect the vitamin content of tomatoes.

Horticulturist H. D. Brown says that a low level of the most critical element —potassium—will reduce the ascorbic acid or vitamin C content of fresh tomatoes as much as 20 per cent. This reduction occurred in tests where fertilizer levels were accurately controlled.

"In terms of human health standards, this reduction in vitamin C is nothing to become alarmed about," Brown states. "Most Ohio soils would not give such results under normal conditions. A more important factor, however, is that improper fertility means a gardener suffers reduced yields from his tomato vines."

Experiments conducted by Brown and his associates showed that extremely low levels of all major fertilizers—nitrogen, phosphorus, and potassium—caused starvation symptoms to appear on the crop and drastically lowered the yields.

Other vegetables tested in this experiment were cabbage and sweet corn. Cabbage quality was similarly affected by lack of certain fertilizers, while corn apparently was unaffected, except in terms of yields.

The Magic of Legumes

CLOVERS, alfalfa, trefoil, and other members of the legume family are the magicians on the farm. They "pull" nitrogen out of the air.

Winston Way, Vermont Extension Assistant Agronomist, explains once you examine them closely you can observe the secret they use. Bacteria which live in warty growths on the roots take nitrogen gas from the soil air and convert it into solid substance.

Did you ever stop to wonder why a fertilizer containing only phosphorus and potash is used on legume hay?

It is not necessary to buy nitrogen for such a crop. An acre of alfalfa will add up to 200 pounds of nitrogen in a year. This is equal to more than 500 pounds of ammonium nitrate which would cost about $25 at current prices. Other legumes are somewhat less efficient.

Legumes produce nitrogen only if the bacteria are present in the soil. Fortunately a farmer can be sure that they are there by purchasing them from his seed dealer and putting them on the seed at planting time. This is called inoculation. To do a good job the inoculum must be fresh (each package is dated) and the right kind for the legume to be grown.

Legume bacteria will work only so long as good care is given them. They prefer to live in "sweet" pleasant surroundings. Most of the soils in Vermont are too acid for the bacteria to work efficiently. This condition should be corrected by adding agricultural lime where needed as shown by a soil test. Use plenty of phosphorus and potash to make sure they are well fed, Way concludes.

Soil and Plant Analyses . . .

(*From page* 25)

during a season of heavy rainfall. To utilize this information, a method has been proposed to measure the movement of soluble salts in the soil by studying the movement of the chloride ion.

The system consists of sinking 10′ x 10′ frames of 12″ boards about 6″ in the soil. As many different conditions as desired can be established, and frames can be placed on as many different types of soil as conditions warrant.

Several installations of frames have been established on different soil types such as Evesboro sand, Woodstown sandy loam, and Sassafras loam, and results on same published. Part of the frames are kept clean cultivated and the others are in sod. After thoroughly sampling the soil, 500 gm. of potassium chloride are dissolved in a given amount of water and sprinkled uniformly over the soil at the beginning of the growing season. Soil samples are taken periodically, usually at monthly intervals, from the 0-9″ and 9-18″ depths. The samples are carefully screened and 50 gm. placed inside of a collodion bag in a 150 ml. extraction flask with 50 ml. of water on the inside and 50 ml. on the outside of the bag. After allowing the chlorides to come to an equilibrium (usually a period of 24 hours), a portion of the clear solution on the outside of the bag is titrated with N/100 silver nitrate using 10% potassium chromate as an indicator. For immediate results, a suitable filtering method or centrifuge may be used in place of the collodion bag.

After a period of heavy railfall the samples can be drawn, the chlorides determined, and, from the previous analyses, the amount of soluble chlorides lost can be calculated. Therefore, interpolations in terms of soluble plant nutrients such as nitrates and accompanying cations can be made. This information has proven very valuable to the growers from the standpoint of furnishing them additional knowledge regarding the amount of fertilizer to use in sidedressing operations. From the standpoint of final yields, the system has been extremely valuable.

Plant Analyses

The analyses of stem tissue during the growing season is very important. This is the simplest way to determine whether or not the plant is getting the desired plant nutrients. If economic returns are important and it is a business enterprise worthy of consideration, then these factors cannot be neglected.

Foliar Symptoms

Foliar symptoms of deficiencies or excesses of nutrients in plant growth are valuable in a diagnostic approach to fertilization. Deficiencies or excesses of nitrogen, phosphorus, potassium, magnesium, boron, and others can be readily seen in leaf structure. Many of the deficiency symptoms have been published in various literature.

Examples of how these factors work to control yields and quality are given in Tables I and II (pages 42 and 43).

Summary

It is suggested that in crop production the following things be considered: soil analyses, plant analyses, foliar symptoms, leaching frames, plant requirements, and fertilizing on the basis of these findings. Many other cases of yield and quality control on the basis of the above factors could be cited but space does not permit.

Table I

Location—Mount Holly, N. J.
Previous Crop: Alfalfa
Soil Tests:

pH	#/A.		Al	% O.M.	NH_4	#/A.	
	Ca	Mg				P	K_2O
6.6	758	214	None	1.8	Poor	31	52

Plant Tissue Tests:

Date	Inches Rainfall	ppm			
		NO_3	P_2O_5	Mg	K
6/20	1.9	579	480+	984	8,780
6/28	1.14	621	480+	288	8,976
7/6	1.52	579	480+	528	6,880
7/12	0.00	398	480+	848	10,480
7/18	1.00	304	480+	1,040	5,600
7/26	0.52	317	480+	912	3,776
8/2	0.14	837	480+	1,040	9,808
8/9	T	184	480+	2,160	5,376

Soil Type: Collington sandy loam

Variety: Rutgers

Lime Treatment: 1½ T. magnesium burnt lime

Fertilizer: 500# 0–14–14 P, 500# 4–12–8 S 10–10–10 Side

Pounds per acre applied:

N	P_2O_5	K_2O	Ca	Mg	S
70	180	160	1335	510	90

Acres Planted: 29 Yield: 15.75 tons per acre

Grade: 73–25–2 $/A.: 535.34

Fungicidal Sprays: 5 Materials: Ziram Copper

Remarks: This is a dairy farm and considerable manure is applied to the fields. This is reflected in the nitrate nitrogen content of the soil throughout the season, also in the amount of amino acids in the tomato puree. Sugar was low and ascorbic acid was low. Color was good. Total titratable acids were quite satisfactory. There was a rather good correlation of the soil analysis, fertilizer applied, and the tomato puree.

Mean Analysis of Puree Sampled: 8/20 and 8/31

pH	m. e./Liter					ppm		Grams/Liter			ppm	m. e./L	Specific Gravity
	Ca	Na	K	N	P	Fe	Mn	Total Solids	Ash	Sugars	Ascorbic Acid	Titratable Acid	
4.5	2.8	1.2	76.5	144.8	16.6	3.2	0.45	65.19	6.34	39.83	196	70	1.0300
Mean of 137 other samples													
4.5	3.2	.88	72.5	110.4	18.0	3.6	0.39	58.2	5.38	36.76	235	62.3	1.0270

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Table II

Location: Medford, N. J.
Previous Crop: White Potatoes
Soil Tests:

pH	#/A.		Al	% O.M	NH_4	#/A.	
	Ca	Mg				P	K_2O
5.3	477	242	Low	1.0	Poor	10	106

Plant Tissue Tests:

Date	Inches Rainfall	ppm			
		NO_3	P_2O_5	Mg	K
6/20	1.90	330	480+	368	10,030
6/28	1.14	515	480+	202	9,360
7/6	1.52	398	480+	272	6,880
7/12	0.00	94	480+	560	9,168
7/18	1.00	38	480+	976	10,032
7/26	0.52	108	480+	416	5,984
8/2	0.14	157	480+	1,488	11,928

Soil Type: Collington sandy loam

Variety: Improved Garden State

Lime Treatment: 1 T. magnesium limestone

Fertilizer: 400# 5–10–10 row, 500# 5–10–10 side 500# 7–7–7 side

Pounds per acre applied:

N	P_2O_5	K_2O	Ca	Mg	S
80	125	125	500	170	65

Acres Planted: 40 Yield 9.86 T/A.

Grade: 73–25–2 $/A.: 334.07

Fungicidal Sprays: 5 Materials: Ziram Copper

Remarks: It was observed on July 12 that the nitrate nitrogen dropped distinctly but was regained on 7/26, no doubt through the application of some nitrogen material. Potash was maintained high throughout the season in the plant tissue. The color was satisfactory with high sugar and ascorbic acid content. The nitrogen and phosphorus content was somewhat below the other samples analyzed.

Mean Analysis of Puree Sampled: 8/20 and 8/31

pH	m. e./Liter					ppm		Grams/Liter			ppm	m. e./L	Specific Gravity
	Ca	Na	K	N	P	Fe	Mn	Total Solids	Ash	Sugars	Ascorbic Acid	Titratable Acid	
4.5	2.3	.83	73.4	101.8	14.7	3.07	0.65	67.22	5.93	44.64	278	57.5	1.0306
Mean of 137 other samples													
4.5	3.2	.88	72.5	110.4	18.0	3.6	0.39	58.2	5.38	36.76	235	62.3	1.0270

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Lime and Fertilizer Pay Off

(*From page* 12)

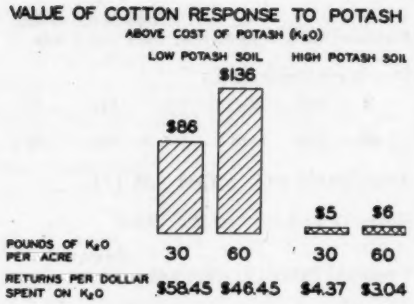

Fig. 4. Cotton responds to potash on soils low in potassium. On such soils, 30 pounds of K_2O per acre increased the value $86, while 60 pounds increased the value $136. On the high-potassium soil, 30 pounds of K_2O per acre gave a return of only $5; however, enough potash should be used to maintain the high level. Eighty per cent of the cotton soils in North Carolina need at least 60 pounds of K_2O per acre (equal to K_2O in 600 pounds of 5-10-10). Three-year average on Norfolk sandy loam and Cecil loam respectively. Adequate nitrogen, phosphate, and lime were applied.

fertilizer at the higher rates (Figure 4). This is the result of the size of response being less for successive additions of any given treatment.

The importance of lime in obtaining a good response from fertilizer is illustrated in Figure 5. With 400 pounds per acre of 0-10-20 on soybeans the value of the response was only $7 above the cost of the fertilizer. When lime was used in addition to 0-10-20 the return was $26 above the cost of the lime and fertilizer. Many other examples could be cited to demonstrate the importance of using enough of the right fertilizer along with sufficient lime.

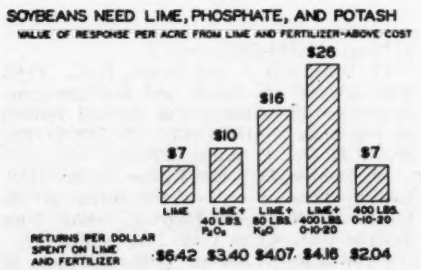

Fig. 5. Soybeans need lime, phosphate, and potash for top returns. Lime alone or 400 pounds of 0-10-20 alone increased the value of the soybeans $7 per acre. Both together returned $26 per acre. This shows the importance of lime in obtaining an efficient return from fertilizer. Average of nine experiments in Coastal Plain.

Soil testing is one of the first steps in learning the specific lime and fertilizer needs for any field. Most farmers in North Carolina know about the soil testing program carried on by the Soil Testing Division of the North Carolina Department of Agriculture. Even though large numbers of samples are tested annually, many more farmers should be encouraged to make use of this service. More lime and fertilizer could be profitably used in North Carolina, but it must be applied in a sound and intelligent way in order to obtain greatest returns. A scientific approach to a practical problem is to test soils and adjust lime and fertilizer applications in line with need.

Summaries of soil tests by counties and cropping areas are being used to point out the average fertility levels in given cropping systems. Local agricultural leaders including fertilizer dealers know the general fertilizer recommendations for these average fertility levels.

Fertilizer costs stand out clearly in the farmer's mind. With a shortage of money or credit the natural tendency may be to cut back a little on the expenditure for fertilizer. Our information clearly shows the importance of lime and fertilizer in increasing profits, however, and the untiring efforts of the agricultural workers, the credit agencies, and the fertilizer industry on a sound fertilization program are essential.

Feed in the Northeast . . .

(*From page* 18)

viously had relatively large exportable surpluses of human foods to sell in the world's markets." (From "Marginal Land in Britain," by W. Ellison, Geoffrey Bles, Ltd., London, 1953.)

It is a well-known fact that the farmer is receiving a smaller and smaller share of the consumer's dollar. Since 1945 it has fallen from 54 cents to barely 44 cents at present. This 10-cent loss to the farmer isn't due merely to reduced farm prices. More of it is caused by increases in marketing charges. Ten increases have been granted in railroad freight rates. The wages paid for labor, the biggest item, have been raised all along the line.

One of the best ways for the dairy farmers of the Northeast to increase their proportion of the consumer's dollar is to reduce their cash expenditures for feed. Many of them already have, or can easily get, the necessary land, machinery, and labor for growing more of their own feed. Cheap feed from the west is probably a thing of the past. The industry of the United States is no longer concentrated in the Northeast. The analogy with England may be closer than you think. The Northeast dairy farmer who produces his own feed will be a more independent farmer. Railroad strikes, crop shortages in the west, government policies more favorable to the politically more potent farmers of the Corn Belt, even wars, will disturb him less than they will disturb his neighbor who is dependent upon that long, costly feed line from the west for his daily needs.

Wisconsin Tops the Nation's 1953 Average Corn Yield

(*From page* 8)

Applied on 50-bushel-per-acre land this fertilizer treatment has produced in many cases an extra 50 bushels of corn. Assuming that yields are increased by 50 bushels with the above treatment and that corn is worth $1.60 a bushel, there is $80 worth of corn at a cost of $43.85. But mind you, there will be a substantial residual value from the plant food contained in the stalks, which, of course, are disced and plowed back into the land. This has been estimated to amount to the equivalent of about 75 pounds of nitrogen, 36 pounds of phosphoric acid (P_2O_5), and 100 lbs. of potash (K_2O). If now, credit is given for 50% of the nitrogen, phosphoric acid, and potash, returned to the land and plowed under with these cornstalks, and if we add also a soil residual of 50% of the P_2O_5 and 40% of the K_2O applied, we can credit our initial fertilizer bill with at least 20 dollars. On this basis for a net investment of $23.85 it is possible to produce an extra $80 worth of corn. Here then, is nearly $4 return for each dollar invested.

Assuming now that it costs $45 per acre to grow and harvest a 50-bushel crop of corn without fertilizer, we quickly show that the per-bushel cost is about 90¢. But by using an extra $43.85 worth of fertilizer (at a net cost of $23.85) our total costs now for growing an acre of corn amounts to $45 + $23.85 or $68.85. If now we

harvest 100 bushels per acre the cost per bushel is 69¢ and the profit per acre would be $91.15 as compared to $35 from the field making only the 50 bushels per acre.

Certainly there is no substitute for efficiency on our farms. Higher yields mean lowered production costs and bigger profits. Should the pinch come —lower farm prices—the only way the average farmer in Wisconsin can continue to prosper is to raise acre yields and thus cut his production costs per bushel. This means more efficient farming including the use of good rotations, adapted seed, and, of course, the judicious use of fertilizers and lime. In fact, farmers will have to use more

TABLE I.—RESULTS OF 1953 FERTILIZER DEMONSTRATIONS ON CORN

PU = Plow under D = Starter fertilizer drilled S = Sidedressed

Name & address of farmer & soil type	History of field and comments	Population (stalks per acre)	Fertilizer treatment and how applied (lbs.)	Yield per/A bushels	Increase, bushels per acre
Francis Blaska Sun Prairie	No manure low fertility. Oats '53	14,353	100 10–10–10 PU 300 4–16–16 D 200 Am. Nitr. S	102.9	70.7
Carrington silt loam	Middle plot	14,973	300 4–16–16 S	32.2	
	Lower side more fertile	14,628	300 4–16–16 D 200 Am. Nitr. S	87.5	55.3
Sauk Co. Hospital & Home Reedsburg Fox silt loam	No manure Stalk population too low	9,045	1000 10–10–10 PU 200 4–16–16 D 200 Am. Nitr. S	70.4	21.5
			200 4–16–16 D	48.9	
Rudy Gavin R. 1, Stevens Point	No manure	13,780	100 10–10–10 PU 200 4–16–16 D 200 Am. Nitr. S	56.0	23.1
Sandy loam		10,400	200 4–16–16 D	32.9	
		11,830	200 4–16–16 D 200 Am. Nitr. S	46.6	13.7
Elmer Hackbert Rio	High fertility	14,170	1000 10–10–10 PU 300 4–16–16 D 200 Am. Nitr. S	121.2	7.9
Dark sandy loam		14,170	300 4–16–16 D	113.3	
		14,170	300 4–16–16 D 200 Am. Nitr. S	124.3	11.0
Frank Flees, Galloway	No manure	12,000	1000 10–10–10 PU 300 4–16–16 D 200 Am. Nitr. S	85.0	30.0
Fine sandy loam (Central Wisconsin 90-day corn)	Not good corn country	12,000	300 4–16–16 D	55.0	
		12,000	300 4–16–16 D 200 Am. Nitr. S	90.0	35.0

Name & address of farmer & soil type	History of field and comments	Population (stalks per acre)	Fertilizer treatment and how applied (lbs.)	Yield per/A bushels	Increase, bushels per acre
John Wengelski Knowlton	No manure Not good corn country	14,000	1000 10–10–10 PU 300 4–16–16 D 200 Am. Nitr. B	96.0	60.0
Sandy Loam (Central Wisconsin 90-day corn)		14,000	300 4–16–16 D	36.0	
		14,000	300 4–16–16 D 200 Am. Nitr. B	90.0	54.0
Joe Hodgson, Mazomanie	No manure Low fertility	9,880	200 4–16–16 D 120 Am. Nitr. S	64.7	35.1
Sand to sandy loam		10,660	200 4–16–16 D	29.6	
John Blaska Sun Prairie Carrington silt loam	No manure Low fertility	15,075	300 3–16–16 D 80 Anhydrous Ammonia S	80.7	59.8
		15,075	300 4–16–16 D	20.9	
Chas. Aldrich & Sons, Avalon Waukesha silt loam	No manure	16,055	400 0–20–20 D 80 Anhydrous Ammonia S	89.2	38.7
		15,665	400 0–20–20 D	50.5	
Arthur Quarberg, Alma	No manure	11,635	800 10–10–10 PU 150 5–20–20 D 200 Am. Nitr. S	120.0	(For Plow Under) 30.0
Heavy silt loam		10,595	150 5–20–20 D 200 Am. Nitr. S	90.0	
Alfred & John Stark, 6190 N. 91st St. Milwaukee 16	No manure	11,830	900 10–10–10 PU 250 3–9–27 D 200 Am. Nitr. S	120.0	67.5
		10,530	250 3–9–27 D	52.5	
		11,570	250 3–9–27 D 200 Am. Nitr. S	93.0	89
Florien Tomski Deerbrook	No manure	High population	1000 10–10–10 PU 300 3–12–12 D 200 Am. Nitr. S	20.9 tons*	6.5 tons*
(Northern Wisconsin)		High population	300 3–12–12 D	14.4 tons*	
Antigo silt loam		High population	300 3–12–12 D 200 Am. Nitr. S	17.9 tons*	3.5 tons*

* Expressed as tons of silage per acre.

fertilizer and lime as time goes on in order to offset the rapidly growing costs in overhead, including cost of machinery and its repair, higher taxes and cost of living. We must match all of these rising costs with increased yields per acre by making every acre produce more dollars in net profit.

Another point to recognize is the fact that under this program of liberal fertilization and the growing of 100 bushels per acre, we do not deplete the soil as much as where we are growing, let's say, 50 bushels per acre. That's because there is a residual carryover from unused portions of the plant food left in the soil.

Wisconsin and other Midwest farmers by the thousands are using more and more fertilizer and following the practices outlined above. If plant food is available in sufficient quantities, we might reasonably expect to see the average yields of corn on our Wisconsin farms gradually increase from the 1953 average of 58.5 bushels per acre to 75.

The use of fertilizer on the corn crop, we say, is still the backbone of efficient production. It paid off this year, it did last year, it will next year and in the years to come. Good farming,—a job well done anytime, any year,—is always something to be proud of. If a farmer can invest $100 in fertilizer and get $200 back, that's principal back and 100% interest on his money,—and that's good business anytime—anywhere.

Alfalfa Regains Favor with Tennessee Farmers

(*From page* 26)

Table I lists some of the yield data reported by farmers in the alfalfa demonstration program.

TABLE I.—YIELD DATA ON THE POTASH-BORAX DEMONSTRATION PLOTS IN TENNESSEE

County	*Cooperator*	*Per cent Yield of Untreated Area to Treated Area*
Coffee	J. B. Strawn	75.7
Monroe	G. L. Wade	69.8
Monroe	J. M. Barr	88.1
Bedford	James L. Cooper	68.9
Sevier	Bart Snapp	95.0
Marshall	Harper Edmondson	92.5
Lawrence	Sam S. Burnett	62.5
Carter	James K. Sharp	67.5
Carter	Frank A. Anderson	80.0
Warren	Otto Cartwright	71.8
Cumberland	E. E. Ford, Jr.	50.0
Hickman	J. L. Baker	52.3
Perry	W. L. Horner	89.1
Roane	John M. Barnard	70.8
Wayne	R. M. Hughes	60.0
Jefferson	Homer Rickard	77.3
	Total Average...	73.2

Summary

The data presented in the table illustrate the economic importance of adequate fertilization in the production of alfalfa hay. When considering the results of all the reports submitted by farmer cooperators, an average increase in production of 27% was obtained. When alfalfa produced three tons from the normal fertilization practices used by farmers, a yield of four tons was obtained by using recommended amounts of fertilizer materials. If all farmers followed the recommended fertilization practices and obtained the same yield increase per acre as those reporting, the production of hay would be increased by 100,000 to 150,000 tons each year. In addition to the highly significant yield increase from the fertilizer materials used on the treated area, preliminary reports indicate that the life of the stands may be prolonged for two or more years.

Experimental results and farmers' experiences show that alfalfa can be successfully grown if the best known production practices are followed. These practices include: (1) Select land suitable for alfalfa; (2) Prepare a compact, weed-free seedbed; (3) Select a high-yielding, winter-hardy variety; (4) Apply lime in adequate quantity; (5) Use an adequate amount of the right kind of fertilizer; (6) Inoculate seed properly; (7) Do the seeding job right; and (8) Manage the stand carefully.

Soil Testing Improves Soil Management

(*From page* 10)

Home Soil Testing

Portable kits for testing soils are available for home use. Generally, they will do a good job of testing. But most people do not have the experience or the training to interpret the tests for best results. Results with home kits may often be disappointing, especially for those who belong to the garden variety of soil-testing amateurs.

But soil testing need not be done in the home. Nearly all the State Experiment Stations, a few County Extension Directors, and some commercial firms, like fertilizer and seed companies, farm-management specialists, commercial laboratories and canneries, make tests. A small charge is made for this service by some. Usually the people in charge of the testing are competent soil scientists well qualified to make reliable interpretations of the test results and suggestions for treatment of the soil.

Soil samples may be taken to a soil-testing laboratory or mailed. In either case, be sure to give as much information about the soil as possible. This will insure the best possible interpretation of the test results so that reliable treatments can be suggested by the soil scientist.

Irrigating Flue-cured Tobacco

(*From page* 22)

of the larger amount of tobacco.

The interesting thing is, of course, that, with the purchase cost of an average irrigation system being about 125 dollars per acre, the whole system could have been paid for in one year in two of the three years of our experience. To be sure, such seasons occur only every fifth year, but it still is an amazing fact.

Conclusion

The climatic conditions at Oxford, N. C., are not respresentative for the flue-cured tobacco area as a whole. In fact, we know that it is one of the more critical areas in regard to soil moisture conditions. What the recurrence figures are for other locations, with respect to results as obtained in Oxford, N. C., we do not know as yet. Work is under way to determine these very important relationships. Also, there are better tobacco soils than those on which the experiment was done, as well as many that are poorer in regard to moisture-holding properties.

But all evidence together with steadily growing experience on part of the producer points toward a bright future indeed for irrigating tobacco in the Southeast. It will take much of the risk out of the business and put fertilizer practices on a more sound basis. Greater capital investment is needed and also more technical skill and understanding on part of the farmer, a real challenge to progressive operators.

Acknowledgment

Experimental data cited were obtained in cooperation with Mr. T. V. Wilson and Mr. J. M. Carr, N. C. Agric. Exp. Sta.

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Back to the Campus

(*From page* 5)

tion and the one before. But a former student chum, who drew the specifications for the new book emporium, said that economy under current building costs made a plain and box-like structure necessary. At that, he pointed out, the modern addition to the study hours of our youth today cost more than four times what the old traditional colossus did. Had the Regents authorized the same fancy trimmings to the new one as we revered so much in the old one, the charges would have dwarfed those of the capitol itself.

BEING hungry for sustenance and companionship, you debate which restaurant to try—the commodious and richly furnished Student Union or the wait-your-turn lunchroom patronized by many of those existing on slender allowances. This time you choose to enter the little gravy-smelling hole in the wall, where stools for about twenty eaters ring the central serving arena leading at one end to the humble kitchen of the elderly women who make the spot homelike. Inquiring young eyes rest upon you as you stand discreetly behind a muscular lad who has finished his ham and eggs and begins on his three-decker plate of flannel cakes. Next to him are two rather impecunious mathematics instructors who are making practical use of their knowledge of applied reckoning which ekes out prevailing wages. Two pretty girls have their classroom notebooks spread out on the rough counter, a few leaves of the complex study sheets, I observe, dunked in maple syrup. Happily, the man with the A-1 appetite vacates his stool so that I have the great privilege of scrouging myself down on a wobbly seat right beside these young women who are imbibing both food and wisdom with what seems to be joyful avidity. All the conversation between us, however, is strictly confined to passing salt and sugar, the latter commodity to my notion being beside their present personal needs. I turn in desperation to the hearty hulk on my left, but when I attempt to talk rationally on current athletic affairs and recent scores and defeats, he soon gets wised up that I belong to the Class of 1920 and gridiron champions of a bygone time.

One looking for a more austere, dignified, and scholarly retreat to consume victuals and drink may wander as I did a few times into the grand and roomy halls of the aforesaid Union. Though the tablecloths were regularly washed and ironed, the floors groomed and neat, and the waitresses tidy and cute, I fared about the same in social intercourse and brotherly communion. All I could do was watch and listen and overhear and imagine—but as for being accepted in the bosom of the student family, what does a guy without a fraternity to claim expect in this age of organized society?

NEXT I seek the realms of a studious group that I never fully understood —the research scientists to whose mystic clan I have not secured the right password. Yet I always believed them to be human and responsive, as they are

today, despite the burden they bear, tangled in webs of precedent and parallel achievement almost as firmly as the lawyers. Your historical and literary savants in the college we knew so well have a simple litany to chant compared with the maze of current scientific productions which the modern researcher is bound to recognize and respect.

The clamor for basic or fundamental research derives from the huge demand in every walk of industry for applied research. And the cry for applied research stems from our need to meet the demand from consumers for mass distribution. Science is the nub of our present universe, and by interviewing a classic scholar on the campus you soon find out that materialism has edged out spiritual values, by his yardstick at least.

HE and many others who once occupied rather hallowed niches in our younger academic world have some old-fashioned ideas to revive for us. I would hardly dismiss their hunches as jealousy at the fame going to fellows with no greater native sense who happened to pick chemistry or physics a few decades ago.

I say this because many of the men we talk with on this score are themselves well established in literary or historical fields. Their college wages are sufficient for the moment, and they have professional outlets not a whit less compelling and valuable than those of the atomic or chemical or mechanical realms.

What they tell me is just about what they tell you. It is not nostalgia—rather it is a fear for the fate of a nation untaught and ungrounded in some of the classic and traditional lines of learning and philosophy. They believe that many of our youth will grow up deficient in some of the inner values that comprise a "decent regard for the opinions of mankind" or, in another sense, lacking spiritual fuel to drive the material engines. No less a person widely respected in material success

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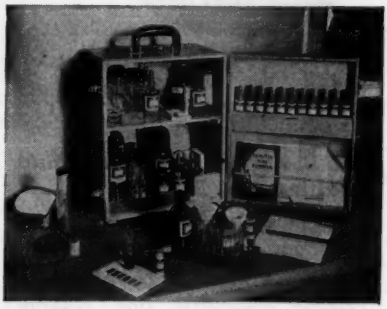

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than Colonel Lindbergh has echoed this idea many times, and the protest is by no means restricted to the doctors of literature or philosophy.

Not that I accuse this old college of ours of deliberately turning its academic back to the flood of doubt and dilemma that seems to prove that science itself is not all there is to wish for. They have been obliged to keep step with the times and they have found outside means of financial aid a mighty factor in adjusting the tempo and the structure of their curriculums. No college in these days can stand serene on the heights of Olympus and braid its classic gown with ivy leaves and laurel. Even football teams and bigger bowls for spectators must be thought of fully and properly catalogued. Each farm and factory is hard pressed by rising costs and seeks the college scientist to pull it through. "Do it" rather than "dream it" kindles the college spirit.

SO I guess we who return for a quickie among the ruins of what we once called our "alma mater" can be highly pleased on the whole at the situation before us. True, there are weak and wobbly spots as there always were and possibly always will be. Much that we see and hear around the campus is strange and unfamiliar; maybe it grates a little betimes.

But accepting things as they are in the onward march of progress, we still keep our right to solace ourselves with those fine and touching memories. For as I believe, each generation will take those same memories and weave them into a sort of hallowed and holy world that once existed in the eyes of youth. They see in old landmarks—human or structural—rugged pointers to the past that have made the present possible, and the future probable. Minor differences and disappointments at not being known and recognized on the well-worn campus paths soon vanish as vapors of the mind. We join hands in vivid recollections and marvel at their outcome. Let's be old grads and not old gripes.

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The Plant Speaks Thru Leaf Analysis (Sound, running time 18 min. on 800-ft. reel.)

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In Canada: The Plant Speaks Thru Deficiency Symptoms
The Plant Speaks, Soil Tests Tell Us Why
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DISTRIBUTORS

Northeast: Educational Film Library, Syracuse University, Syracuse 10, N. Y.

Southeast: Vocational Film Library, Department of Agricultural Education, North Carolina State College, Raleigh, North Carolina.

Lower Mississippi Valley and Southwest: Bureau of Film Service, Department of Educational Extension, Oklahoma A & M College, Stillwater, Oklahoma.

Midwest: Visual Aid Service, University Extension, University of Illinois, Champaign, Illinois.

West: Department of Visual Education, University of California, Berkeley 4, California.
Department of Visual Education, University of California Extension, 405 Hilgard Ave., Los Angeles 24, California.
Department of Visual Instruction, Oregon State College, Corvallis, Oregon.
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Requests should be made well in advance and should include information as to group before which the film is to be shown, date of exhibition (alternative dates if possible), and period of loan.

Request bookings from your nearest distributor.

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S-5-40 What is the Matter with Your Soil?
Y-5-43 Value & Limitations of Methods of Diagnosing Plant Nutrient Needs
A-1-44 What's in That Fertilizer Bag?
QQ-12-44 Leaf Analysis—A Guide to Better Crops
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I-2-47 Fertilizers and Human Health
T-4-47 Fertilizer Practices for Profitable Tobacco
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TT-11-47 How Different Plant Nutrients Influence Plant Growth
VV-11-47 Are You Pasture Conscious?
R-4-48 Needs of the Corn Crop
X-6-48 Applying Fertilizers in Solution
AA-6-48 The Chemical Composition of Agricultural Potash Salts
GG-10-48 Starved Plants Show Their Hunger
OO-11-48 The Use of Soil Sampling Tubes
SS-12-49 Fertilizing Vegetable Crops
F-1-50 A Simplified Field Test for Determining Potassium in Plant Tissue
K-3-50 Metering Dry Fertilizers and Soil Amendments into Irrigation Systems
BB-8-50 Trends in Soil Management of Peach Orchards
I-2-51 Soil Treatment Improves Soybeans
X-8-51 Orchard Fertilization Ground and Foliage
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A-1-52 Research Points the Way to Higher Levels of Peanut Production
D-2-52 Boron for Forage Crops
E-2-52 Ladino Clover—Its Mineral Requirements & Chemical Composition
H-3-52 The Relative Merits of Inorganic & Organic Sources of Plant Nutrients
L-4-52 Efficient Use of Fertilizer in the Southern Region
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X-10-52 The Mineral Uptake by the Sweet Potato
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A-1-53 Phosphate and Potash Effects on Ladino Clover Swards
B-1-53 Commercial Fertilizer Is a Sound Investment
F-2-53 Grasses and Weeds—The Potash Robbers
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Because her little son refused to eat, the frantic mother had taken him to a famous psychiatrist, who coaxed the boy with every kind of conceivable food stuff from candy to nuts, but all in vain.

Finally he asked, "What would you like to eat?"

"Worms," was the boy's calm reply.

Not to be outdone, the medico sent his nurse out for a plate full of large worms. "Here," he snapped at the boy.

"I want them fried," said the youngster.

The nurse took them out and fried them and returned with the plate half full.

"I only want one," said the food hater.

The doctor got rid of all but one. "Now," he barked, "Eat!"

The boy looked hungrily at the single worm. "You eat half," he said.

The Doc did, then dangled the remaining half in front of the little fellow's face. The boy burst out crying.

"What's the matter now?" yelled the famous man.

"You ate my half," sobbed the kid.

* * *

"There were two men senior to me," said the lecturer. "One was dismissed for drunkenness, alcohol led the other into crime; and I am now head of the department. What has raised me to this high position, I ask you?"

"Drink!" roared the enthusiastic audience.

There was a young husband who put a sign on his old, but flashy-looking convertible: "For Sale. Good courting car. As part payment, owner will take household furniture and baby buggy."

* * *

Two visitors were riding down Constitution Avenue, Washington, D. C., in a taxi one day, when they passed the National Archives building. Seeing an inscription, "What is past is prologue," written across the building, one of the passengers asked the driver what it meant.

"That," said the cab man, "is government language. It means "Brother, you ain't seen nothin' yet!"

* * *

Young Lady—"Can you squeeze me in here?"

Bus Driver—"Why, yes, lady, if someone else will drive the bus."

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"Jimmy," said a lady visitor, "why don't you come to our Sunday-school class? A lot of your friends come regularly."

Jimmy hesitated a moment. "Does a red-headed, freckled-faced kid named Sam Brown come?" he asked at length.

"Yes, he does." replied the visitor. "I've never known him to miss a single Sunday."

"Well, in that case," said Jimmy eagerly, "I'll be there next Sunday. I've been wanting to beat that guy up for a month!"

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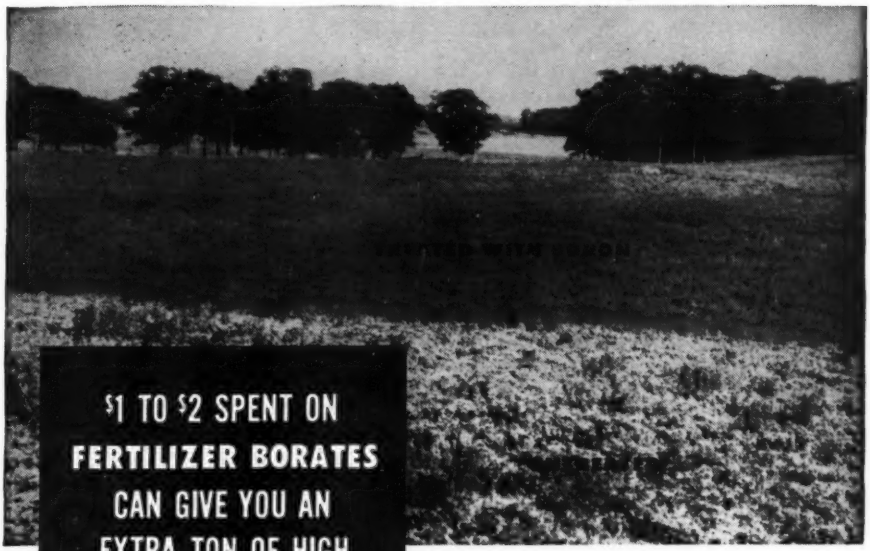

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